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A COMPARISON OF ACTIVE AND PASSIVE PROCESSING FOR NORMALLY ACHIEVING AND LEARNING DISABLED STUDENTS

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled A Comparison of Active and Passive Processing for Normally Achieving and Learning Disabled Students submitted by Glennis Joy Mowatt in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

The effect upon memory recall of an active orienting task was studied with 20 learning disabled and 20 normally achieving children. The normally achieving children were 9 and 10 years of age. Half of the learning disabled children were of the same chronological age as the normally achieving children; half were two years older, but matched in reading level, with the normally achieving group.

The active orienting task used was the generation of opposites task developed by Slamecka and Graf (1978) and found to increase adult memory in a variety of conditions. The passive task was reading opposites. The children either read word pair opposites (up down) or generated the second word of a pair (up d---) using as cues the first letter of the second word. Read/generate was a within subject factor; each child was required to perform both read and generate tasks.

Each child also participated in two learning conditions: intentional and incidental.

Using as a framework Torgesen's (1977, 1980) conceptualization of the learning disabled child as a passive learner, the study hypothesized that (1) the active orienting task would improve the recall of learning disabled children and (2) the intentional learning condition would not result in significant memory gains for the learning disabled child.

Normally achieving children were also expected to improve

in recall following the active generating task. The intentional condition was expected to result in significantly greater recall than the incidental condition.

The results found that the active orienting task improved memory in normally achieving, but not learning disabled, children. Neither learning disabled or normally achieving children showed significant memory difference between the incidental and intentional learning conditions.

Further suggestions for study included extending the study to older age groups of learning disabled children and increasing the sample size.

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CHAPTER 1

INTRODUCTION

Information processing views intelligence as a process of "acquiring, storing in memory, retrieving, combining, comparing and using in new contexts information and conceptual skills" (Humphreys, 1979, p. 115). Basically, then, information processing is concerned with the skills involved in acquiring information from the environment, storing this information, and making use of it. Within this framework, memory is viewed, not as a unitary construct, but as a set of capacities, a multi-faceted skill dependent upon a variety of subskills that enable the individual to encode, store, and retrieve information in order to make sense of the environment (Reid & Hresko, 1981).

Individuals do not perform equally on memory tasks. Within information processing theory, individual differences are assumed to result from three sources: basic structural differences, choice of strategy, and allocation of resources (Hunt, 1980).

Research in the past decade in developmental child memory has concentrated upon the second of Hunt's sources of individual difference: choice of strategy. While the exact parameters of the term "strategic behaviour" have not yet been established (Swanson, 1982; Wong, in press), generally the term refers to the voluntary aspect of memory, the control exercised by the individual over the memory process, in contrast to the automatic processes more closely

allied with structural considerations. As age increases, so does the skill with which the child exercises memory strategies to interact with the environment in such a way that present events become represented and stored in the memory system (Hagen, Jongeward & Kail, 1975). The child is viewed as an active participant in his/her own memory construction.

Recent memory research with learning disabled children has followed developmental research lines. Attention has been directed towards the voluntary aspect of memory. However, while research with normally achieving populations has followed strategic memory development as the main source of individual difference, evidence for both structural and strategic differences have been found in memory studies with the learning disabled. There is not agreement upon this point. Is the learning disabled child deficient in memory skill because of a structural or a functional strategic deficiency? Or, additionally, is there some as yet unexplained interaction between the two? The answers to these questions are of more than theoretical interest to the field. There are obvious educational implications stemming from each source of possible deficiency. If structural capacity is at fault, traditional compensatory educational techniques are called for; if functional limitation, strategic deficiencies, are at fault, appropriate remedial training measures need to be taken.

While learning disability research is renowned for its fragmentation, a fairly recent formulation by Torgesen (1977; 1980) has provided a conceptual rallying point for the field. He portrays the learning disabled child as a passive rather than an active

participant in his or her own learning. The learning disabled child is seen as passive rather than active in the very processes traced by developmental research as bringing about increased memory efficiency. That is, the learning disabled child is assumed to lack active interaction with the environment in a purposeful way, to lack active organizational and constructive skills, to lack adaptive strategic behaviour. This lack of purposeful activity is linked with the concept of intentional learning. As discussed by Torgesen (1977), the learning disabled child does not lack capacity to learn, but s/he is deficient in purposefully interacting in intentional learning situations. In pre-school years, learning is primarily incidental. It is only when formal schooling is begun that intentional learning becomes paramount. Hence, the learning disabled child's incidental learning ability is reflected in his/her average or above average IQ. The intentional learning ability is reflected in his/her poor level of academic achievement (pp. 35-38).

There has not yet been sufficient time for much research to be conducted with the active/passive framework of learning disabilities. Consequently, as Wong expresses it

> . . . the 'inactive learner' framework is crippled by the absence of explicit formulations on (a) the underlying mechanisms and (b) the conditions under which learning disabled students may exhibit strategic problems. Consequently, in its existent form the 'inactive learner' framework is weak. (in press)

Within the active/passive concept of the learning disabled child, there are two potential sources for memory improvement. One is to train meta-cognitive variables. This is the approach adopted by Wong (1979; 1982; Wong & Jones, 1982). The other is to develop

suitable orienting tasks. One instructional strategy to improve memory is to provide training in strategic behaviour; another is to structure the task so that beneficial processing is required. As noted by Rohwer and Dempster (1977) in their discussion of educational practices, such orienting tasks have shown promise in producing results (p. 426). Research into the use of active orienting tasks with learning disabled children would not only serve to begin to sketch in some of the many gaps existing in present learning disability theoretical formulations, but could serve as potentially useful for classroom instruction. Torgesen notes of orienting tasks that "research to develop such orienting tasks (Jenkins, 1974) would be one good place to start bridging the gap between basic research and educational practice" (1980, p. 26).

In spite of the need for research into active orienting tasks, little research has been conducted in this area. A few studies have investigated categorization (Dallago & Moely, 1980; Wong, Wong & Foth, 1978) or labelling (Lewis & Kass, 1982) as an orienting task. The present study will use an active orienting task developed by Slamenka and Graf (1978) to study the effects of such a task upon the recall memory of normally achieving and learning disabled children.

A second component of the study will be a comparison of incidental and intentional memory. Studies with normal children have concentrated upon intentional memory (Brown, 1975); in particular, the intentional use of various memory strategies. Learning disability memory research has tended to separately study

either intentional or incidental memory. A comparison of the two learning conditions with the learning disabled children takes on added significance in the light of Torgesen's (1977, 1980) designation of the learning disabled child as a passive learner who does not respond efficiently to the intentional learning required in the school setting. The present study will allow for a comparison of the effect of incidental and intentional learning conditions upon the recall memory of learning disabled and normally achieving children. As well, since both an active and a passive orienting task will be given to each child under both types of learning condition, there will be an opportunity to observe the interaction between the two orienting tasks, active and passive, and the two learning conditions, incidental and intentional.

The present study, in brief, regards the learning disabled child within the active/passive framework provided by Torgesen (1977, 1980). It attempts to compare the memory effects upon learning disabled and normally achieving children of (1) an active orienting task and (2) incidental and intentional learning conditions.

CHAPTER 2

SELECTIVE REVIEW OF THE LITERATURE

Memory Models

Multistore Model

In multistore theory, as exemplified by the Atkinson and Shiffrin model (1971), memory is considered to be the data retained in the system; attention is focused upon the structures containing the information. Memory information is considered as being held and then transferred along from one storage depot to the next. These storage depots are designated sensory register, short term, and long term store, with increasingly lengthy periods of holding time occuring at each point. Hence, while sensory registers are limited in holding time to 2 seconds, short term holding time is considered to be about 30 seconds, and long term store can involve years (Norman, 1976, p. 122).

Central to multistore theory is the consideration of capacity. In contrast to long term and sensory registers, the capacity of the short term store is regarded as being very small, typically 7 ± 2 units of information for an adult (Miller, 1956). Since information is only held in short term for up to 30 seconds, incoming information will displace items already there. Data that is not transferred within that time alottment will be lost from the system and forgotten. This transfer of information from short to long term store is thought to depend upon the use of the control process

called rehearsal.

There is provision in the multistore model for the memory processes of encoding, retrieval, and attention, in addition to rehearsal, but these are not central features of the model. The nature and capacity of the various stores is the focal point.

Levels of Processing

Levels of processing (Craik & Lockart, 1972) emphasizes the way information is processed, and specifically, the depth to which information is processed. "Trace persistence is a function of depth of analysis, with deeper levels of analysis associated with more elaborate, longer lasting and stronger traces" (p. 675). The incoming stimulus is seen as being processed at progressively deeper levels, passing from a preliminary analysis to pattern recognition, to an associative level. The deeper the level of processing, the better the retention of information.

Levels of processing provides for two forms of rehearsal. Maintenance rehearsal involves maintaining processing at the same level; elaborative rehearsal is presumed to increase memory strength by involving processing to deeper levels (Craik, 1981).

Revisions to the original formulation of the model (Craik & Lockhart, 1972) have resulted primarily from the collaborative work of Craik and Jacoby (1979) and Craik and Tulving (1975). As outlined by Jacoby and Craik (1979) these elaborations to the original notion of levels of processing primarily involve the concept of breadth of processing, the importance of context in encoding and retrieval, and, relatedly, the role of distinctiveness in encoding.

Two models compared

The basic difference in multistore and levels of processing models is one of emphasis. While both agree that attention, time factors, and the number of features analyzed play a part in retention, multistore emphasizes the importance of the place of storage in retention; levels of processing emphasizes the processes involved in encoding. Limited capacity of the short term store is a central feature of the multistore model. The level of processing model views capacity as a consequence of limited processing. These differing points of emphasis reflect structuralist/functionalist perspectives, which are in turn reflected in their selective use in the literature to explain memory findings.

Developmental Memory Model

Brown in 1975 outlined a developmental memory model which has become very influential. Brown, drawing heavily from the work of Flavell, distinguished between the development of the knowledge system underlying cognitive development, knowing; metamemory, knowing about knowing; and strategic memory, knowing how to know. Memory strategies are seen as the means by which material is organized, transfixed, or maintained at a given level of processing in such a way that a more efficient use is made of the limited capacity of the memory.

Here a close relationship between memory strategies and levels of processing theory can be seen. Further, memory strategy is regarded as a voluntary plan; it is not essential for, but facilitates task performance. Subject initiated activities, then,

are regarded as improving memory performance.

The development of strategic memory behaviour is seen as passing through a series of stages.

> First, the strategy is absent (a stage of "mediation deficiency"); then it is available but not used unless induced and used inefficiently even when induced ("production deficiency"); next, the strategy is available and if induced is used efficiently (the mature stage). There is also a developmental progression in the complexity of strategies, resulting from coordinations of simpler strategies. The strategies are organized hierarchially, and higher-order strategies are not only more complex but also more effective. (Reese, 1976, p. 207)

While the distinctions made by Brown, particularly regarding the strategic versus non-strategic task distinction, have served to focus developmental research on significant memory tasks, Brown's model is essentially practical rather than theoretical in nature. Developmentalists must borrow from multistore and levels of processing models to explain their findings. As Solso (1979) puts it, the developmental viewpoint is largely a descriptive one, more committed to studying change over age than to a coherent theoretical position.

Developmental Memory Findings

The analysis of a memory task can be expected to yield information concerning:

> (a) identification of the component processes in task performance, (b) specification of the internal representation or representations of information on which the component processes act, (c) specification of the strategy or strategies by which both different component processes and multiple executions of the same component process are combined, (d) discovery of the

> consistency with which the various strategies are employed by individual subjects, (e) estimation of the duration, difficulty, and probability of execution of each component process. (Sternberg, 1979, p. 222)

Developmental research has tended to emphasize (c), (d) and, to a lesser extent (a) of the above features, while (b) has received relatively little attention.

The studies reviewed in this section have been organized into the two divisions of strategies and encoding. To some extent, this division is an artificial one as there is a large degree of overlap between the two areas. Further, one study can yield information concerning both memory representation and strategic behaviour. As well, both areas are concerned with the operations performed by the subject upon the stimulus to transform it from the nominal stimulus presented by the experimenter to the functional stimulus represented in the memory system (Herriot, 1974). However, encoding interpretations of data tend to emphasize the nature of the stimulus (for example, a phonetic or semantic level of analysis); strategic interpretations tend to emphasize the meta-cognitive behaviour of the individual. While strategic behaviour is considered to fall completely within the voluntary control of the individual (Brown, 1975), there is less degree of certainty about the degree of automatic and voluntary processing involved in encoding (Herriot, 1974).

Strategic memory

Recognition memory shows little, if any, change with age (Kail, 1979). Recall memory, however, does change with age. Much of

the developmental research of the past decade has been concerned with tracing the development of the various memory strategies used in recall.

Organizational strategies have been most often studied with children using experimenter determined categories that permit an examination of the way the children did or did not make use of the categories to aid recall. Categorical organization is seen as a means of reducing the load on memory capacity be allowing items to be stored and retrived by a common coding (Herriot, 1974). The ability to benefit from categorical organization is seen as dependent upon the child's knowledge base and his/her awareness of meta-cognitive variables (Lange, 1978). Studies seek to find the age at which children first show a tendency to search for categorical organization as well as the relationship shown at different age levels between total recall and the degree of categorical organization.

Studies have shown there is little evidence that children under 6 years of age spontaneously use categories (Lange, 1978), although young children benefit from categorization imposed by the experimenter (Kobasigawa & Middleton, 1972). A study of the use of categories as retrieval cues with 6, 8, and 11 year olds where the use of categories was made available to children if they wished to use it, showed that the percentage of children spontaneously using category clues increased from 33% at age 6 to 90% at age 11 (Kobasigawa, 1974). As well, this strategy was used more efficiently with increasing age levels as determined by mean recall for children using the categorization strategy. Studies reported by Lange (1978)

in the meta-cognition of organization find that by the age of 7 or 8 years, children are aware that organization facilitates recall.

In a related area, rehearsal strategies have been studied in two major ways: the direct observation of rehearsal (eg. watching lip movements) and inferring rehearsal from the study of serial position recall curves. These two methods of rehearsal study probably tap different processes, according to levels of processing theory. Studies of overt rehearsal measure a maintenance type of rehearsal that serves to keep items in working memory; serial position analysis looks at the effect of elaborative rehearsal that leads to improved memory through deeper processing (Cuvo, 1975).

Overt rehearsal studies tend to show that while younger children may rehearse, their rehearsal is less organized and effective than that of older children (Ornstein & Nauss, 1978).

Serial position studies report that the major difference between older and younger children is that the older children show more primacy effect (Chi, 1976; Cole, Frankel & Sharp, 1971). That is, older children recall more items from the portion of the list first presented than do younger children. This is thought to be the result of increased rehearsal which in the multistore theory allows material to be processed from short to long term memory store (Marshall, Anderson & Tate, 1976) or, in levels of processing terms, allows material to be more elaborately analyzed (Cuvo, 1975). As well, improved primacy may result from improved retrieval strategies (Chechile, Richman, Topinka & Ehrensbeck, 1981; Ford & Keating, 1981).

Since different strategies uniformly show increasing use and

efficiency with age, it seems reasonable to assume the development of a general strategic factor. One study of strategic memory in 8 and 11 year olds found limited support for the existence of a general strategic factor developing by age 11 (Kail, 1979).

Although numerous studies document memory development as a result of strategic awareness and skill, there are alternatives. One is that the memory span increases with age as a result of greater ease in identifying incoming items and encoding them (Huttenlocher & Burke, 1976). Another is that the rate of processing may increase with age, allowing for the encoding of more features (Reid & Hresko, 1981). Attentional resource allocation may also be a factor (Hunt, 1981).

Encoding

Several studies have been conducted to determine the semantic attributes used by children to encode. As summarized by Hagen and his associates (1975), the results in general are consistent with adult findings. That is, semantic attributes, such as taxonomic encoding, that are a primary feature of adult encoding, are found in very young children. Attributes less salient for adults develop in late childhood years.

Studies have also attempted to determine the relative dominance of attributes during developmental years. Encoding for children ages 4, 5, and 9 years in a visual presentation of stimuli has been found to shift with age from perceptual attributes (eg. colour) to conceptual attributes (Melkman, Tversky & Baratz, 1981).

Auditory presentation of stimuli has been found to show a developmental shift from encoding acoustic features, the sound of the word, to semantic features, the meaning of the word (Hagen, Jongeward & Kail, 1975). Thus, for both visual and auditory encoding a shift has been reported to more conceptual attributes, or, in level of processing terms, deeper processing, at older ages.

Results from studies of the speed of encoding suggest that developmental changes in speed of encoding do occur with faster rates found in adults than children (Chi, 1976; Reid & Hresko, 1981). Part of the increase in encoding speed is attributed to familiarity with the stimuli.

Incidental/Intentional Memory

The defining characteristic of incidental learning is that "the subject is asked to process information with no knowledge that he or she will be later tested for memory of the presented information" (Reynolds & Flagg, 1977, p. 205). In contrast, intentional learning involves the subject's awareness of the memory task to follow. A comparison of the two measures allows for the study of the subject's deliberate attempts to process information.

This aspect of memory has received little attention in developmental literature in recent years because of the emphasis upon the levels of processing concept which emphasizes that the type of process, not the degree of intentionality, is the significant factor in memory. However, studies with adults do show that different types of encoding and/or storage are carried out as a

result of the anticipation of different types of memory tasks (Carey & Lockart, 1973; Tversky, 1973).

The importance of the intentional/incidental variable in children's memory is discussed by Flavell (1977, pp. 208-210) using the term "sensitivity" to describe the child's objective need for preparation for future storage and retrieval of information. He distinguishes between deliberate memorizing, which calls for intentional storage attempts, and deliberate retrieval, which involves intentionally retrieving memory information upon request. Deliberate memorizing is seen as developing later than deliberate retrieval. Very few studies have looked at the intentional/incidental comparison of children's memory in respect to memory organization. As Flavell puts it, "we know next to nothing about the genesis of spontaneous as contrasted with instructed storage and retrieval attempts" (Flavell, 1977, p. 210).

Incidental/intentional memory has been studied, however, with respect to the development of attention using the selective attention task developed by Hagen (Hagen & Stanovich, 1977). The child is given a specific learning task to do while s/he is also exposed to material irrelevant to the task. Recall measures are taken at the task conclusion of both the central learning material as well as the incidental material. The degree of discrepancy between the two measures is considered a measure of selective attention ability.

Studies with this selective attention task show increasing attention to the central task with increasing age (Wheeler & Dusek,

1973). This is interpreted as

> a shift from the control of attention by salient features of stimuli toward its control by logical features of the task, and a shift from passively tracked to actively sequence attending. Moreover, this developmental change appears to be marked by a transitional period in which the intentional and goal-directed aspects of deliberate search are fairly well developed, and the capacity of salient features to capture attention is no longer particularly helpful, even when such features are informative, but is still a major source of interference when they are distracting or irrelevant. (Wright & Vlietstra, 1975)

In summary, many studies support the idea that the main developmental change in memory occurs as a result of the processes that control the flow of information (multistore model) or permit deeper levels of encoding (levels of processing theory). These are voluntary aspects of memory (Brown's distinction). As the child develops s/he becomes increasingly active in his/her efforts to remember.

Marked changes in memory occur between preschool and early adolescent years as the result of the gradual acquisition and mastery of memory strategies (Hagen, Jongeward & Kail, 1975). These strategies appear to develop because of an increased knowledge base (Torgesen & Kail, 1980; Swanson, 1982) and metamemory skills (Flavell, 1970). The latter point, however, is currently under investigation regarding the question of whether or not a direct link does exist between metacognition and task performance (Cavanaugh & Perlmutter, 1972; Wong, in press).

While strategic changes in behaviour account for much of the developmental changes in memory over age, they do not account

for it all. An additional factor may be efficiency in encoding as the result of structural growth (Reid & Hresko, 1981; Huttenlocher & Burke, 1976). Increased attentional resource (Wright & Vlietstra, 1975) may be a factor as well, but at present not enough is known to reliably separate out meta-cognitive and structural features from attention (Bauer, 1979; Kail, 1979).

While incidental/intentional memory comparisons have been made regarding the development of selective attention (Hagen & Stanovich, 1977; Wheeler & Dusek, 1973), there has been very little study of incidental/intentional memory regarding other processes such as organization or encoding.

Memory of Learning Disabled Children

Definition of Learning Disabled

The most widely used formal definition of learning disability was formulated in 1968 by the United States National Advisory Committee on Handicapped Children. The definition read:

> "Specific learning disability" means a disorder in one or more of the basic psychological processes involved in understanding or in using language spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasis. The term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage. (NACHC definition quoted by Wong, in press, p. 3)

Criticisms of this definition centered around the exclusion

of individuals that had learning disabilities in conjunction with other handicapping conditions, the exclusion of adults, and the vagueness represented by the listing of such diverse conditions as brain injured, perceptual handicaps, etc. (Leong, 1982; Wong, in press).

In response to criticisms such as the above, a new definition was formulated in 1981 by the United States National Joint Committee for Learning Disabilities. This reads that learning disabilities is

> a generic term that refers to a hetergeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities. These disorders are intrinsic to the individual and presumed to be due to central nervous system dysfunction. Even though a learning disability may occur concomitantly with other handicapping conditions (eg. sensory impairment, mental retardation, social and emotional disturbance) or environmental influences (eg. cultural differences, insufficient/inappropriate instruction, psychogenic factors), it is not the direct result of those conditions or influences. (NJCLD definition quoted by Wong, in press, p. 5)

Problems in learning disabled memory research

While memory is one of the most heavily studied areas in learning disability research (Torgesen & Dice, 1980), research in this area is not without problems. Problems are manifested in the areas of sample definition (Torgesen & Kail, 1980) and failure to systematically study meaningful memory variables (Cermak, Reid & Hresko, 1981). As a result, work in the area is fragmented.

By far the most widely used criteria for the selection of learning disabled subjects has been the discrepancy between the

child's assumed potential, as measured by IQ, and his/her actual school achievement (Torgesen & Dice, 1980). Reading achievement is almost exclusively the criteria used as a measure of school achievement (Torgesen & Dice, 1980). One problem here is the lack of consistency from study to study of the operational definition of "underachievement". Further, when reading underachievement alone is used as the crucial criteria, it increases the probability that the identified children may have reading problems solely as the result of cultural factors, instructional factors, and other of the factors specifically ruled out as the result cause of learning disability in the NJCLD definition. Thus, reading underachievement may be erroneously equated with learning disability. Sole reliance upon reading underachievement as the operational definition of learning disabled results in studies of presumed learning disabled children who are not so defined by their school systems. "While there is nothing inherently wrong with this practice, it should alert us to the possibilities that many conclusions from the research may not apply to children who have the most severe kinds of learning difficulties" (Torgesen & Dice, 1980, p. 7).

In addition to problems of sample definition, learning disabled memory research is complicated by the fact that memory itself is not a unitary construct (Hall, 1980) and research has lacked systematic investigation of theoretical constructs. Depending upon the particular memory variables under study, several explanations may exist for the failure of the child to perform a specific memory task. Torgesen (1980) feels that learning disabled

memory research has often contented itself with simple descriptions of success or failure at memory tasks, and failed to search for meaningful variables related to a specific memory theory. Cermak (1981) states that learning disabled research has often failed to translate memory theory into useful experimental paradigins. Reid & Hresko (1981) decrie the lack of systematic study of memory problems.

Strategic memory

As discussed in developmental memory, Brown (1975) made a distinction between the strategic, voluntary aspects of memory, amenable to developmental change, and those non-strategic, relatively invarient aspects of memory. Ceci (1982a, 1982b) investigated these voluntary and non-voluntary aspects of memory in learning disabled children within the framework of what he termed automatic and purposive processing of semantic information. Automatic processing he termed involuntary, non-intentional processing; purposive processing involved subject-controlled, intentional focussing upon the meaning of the stimuli. He discussed automatic processing as limited by the capacity of the system; purposive processing by the amount of effort allocated by the subject.

Ceci conducted a series of experiments into automatic and purposive processing. One study (1982a) with 10 year old learning disabled and normal children used rather complex video apparatus. As the child watched a video presentation of spacecraft, s/he heard words presented at 4 second intervals. The child was told to remember the words that were spoken when the spacecraft s/he was

watching was destroyed. Automatic responses were monitored by Skin Conductance Response. In the second phase of the experiment, the same words listened to in the first phase were again presented, but spoken so that the child heard one word spoken in one ear by a male voice simultaneously with another word spoken in the other ear by a female voice. The child was instructed to listen to one voice only. The Skin Conductance Response was again monitored. In particular, the response was noted when one of the two presented words was one of the voices associated in phase one with the spacecraft destruction. Both learning disabled and normal children showed Skin Conductance responses to the target words even when it was spoken in an unattended voice and they were not consciously aware that the word was spoken. The results were interpreted as support for the idea that learning disabled children do not differ from normal children in automatic semantic processing.

Ceci (1982b) conducted another study where 10 year old learning disabled children were matched with normal children at two age levels, 4 and 10 years. The children were shown slides of familiar objects and required to name them as quickly as possible. Before each slide, an auditory cue was given. This cue was either semantically related to the picture, unrelated or neutral. Children participated in a purposive condition where a high percentage of cues were semantically related and an automatic condition where only 10% of the cues were related to the pictures. The results were measured by naming times using a cost and benefit scheme. The analysis of results showed that while automatic processing was

invariant for all children, the purposive processing of the 10 year old learning disabled children was similar to that of the 4 year old normals. Both 10 year old learning disabled children and 4 year old normal children failed to strategically distinguish between conditions where auditory cues were helpful and where they were not. In contrast, normal 10 year olds used strategic behaviour to benefit from the types of cues. Ceci interprets these findings as evidence of (1) a developmental lag, (2) lack of processing to deep levels in learning disabled children, (3) lack of meta-skills in learning disabled children. It should be noted that while Ceci terms learning disabled abnormal children as not differing in this study in automatic processing, the results show a slower naming speed for the learning disabled children. Although both groups show a similar pattern of reaction times to types of stimuli, the actual speed of semantic judgement is slower for the learning disabled group.

Organizational strategic studies with the learning disabled have been primarily in the area of categorical organization.

An intentional memory study with grade 4 and 5 learning disabled children and normally achieving children was conducted by Wong, Wong and Foth (1977). The children read aloud words from four categories. Word lists were not blocked into categories. In the cued condition, the children read aloud the word and also the category to which the word belonged. In the no-cue condition, the children read only the word. The results showed that normally achieving children were able to recall more words in both cued and non-cued conditions. This was interpreted as indicative that

learning disabled children were unable to generate their own mneumonic cues in the no-cue condition, and less able to benefit from the organizational strategy suggested in the cued condition. However, it should be noted that, while the recall of learning disabled children was less than normals in each condition, they showed the same pattern of response: cued was better than no cue for both groups.

Similar results were obtained in a study using pictures as stimuli (Dallago & Moely, 1980). This study involved 45 learning disabled and 45 normal children between 9 and 11 years of age. Recall was compared following sorting the pictures by perceptual attributes, sorting by conceptual categories, and free sorting. The perceptual and conceptual sorting involved a guided strategy; free sorting allowed the child to use spontaneous strategy. Recall results showed greatest differences between the learning disabled and normal children in the free sort condition. This again was interpreted as evidence that learning disabled children are less able than normals to spontaneously organize stimuli. In the categorical sorting condition, the recall of the learning disabled was very similar to that of the normal groups. This is interpreted as providing evidence that when guided in strategy use, learning disabled children are "well able to use semantic organization in recall" (p. 71).

A similar study was conducted with poor and good readers in the fourth grade (Torgesen & Murphy, 1979). Children in the first phase of the experiment were told to memorize the pictures. In the

second phase, they were told to categorize the pictures. The orienting task in the second phase succeeded in eliminating recall differences between the two groups of readers.

Feston and Drew (1974), however, in a widely quoted study, found learning disabled children unable to benefit from the experimenter's categorical organization of the material. This study involved 48 children diagnosed as having "organic brain syndrome" as described by the American Psychiatric Association. Results were social, emotional and learning impairment; they were enrolled in a private remedial clinic. The age range was 7 to 17 years with a mean age of 10.96 years. Word lists were auditorily presented. The word lists were of two types: categorically organized and unorganized. The results showed no difference in recall for the two types of lists; that is, the learning disabled children did no better on the organized than unorganized lists. Thus, it appeared they were unable to benefit from experimenter organization. Possible reasons for the difference in results between this study and preceding two are: (1) subject selection - the clinical population of Feston and Drew represent more severly learning disabled children; (2) the auditory presentation as opposed to the visual stimuli used in the preceding studies - this is not likely because Lorsbach (1982) reports the ability of the learning disabled to respond to classification in an auditory study; (3) the task used here did not require the same degree of active processing required in the tasks of either Wong, Wong and Foth, Dallago and Moely, or Torgesen and Murphy.

While rehearsal strategies have been rather thoroughly studied in developmental literature, research in this area with the learning disabled is much more limited.

The use of overt rehearsal strategies was studied with good and poor readers at a second grade level (Torgesen & Goldman, 1977). The results here showed that poor readers had less observed rehearsal as measured by lip movements and dectable speech as well as poorer recall than good readers.

In the area of serial position studies, generally recall performance for learning disabled children and poor readers is found to be poorer than normal children in the primacy portion of the recall curve (Bauer, 1979; Bauserman & Orbzut, 1981; Tarver, Hallahan, Kauffman & Ball, 1976). The lower primacy may be due to a deficiency in elaborative processing (Bauer, 1979). That is, drawing from levels of processing viewpoint, elaborative processing is seen as permitting deeper levels of processing (Craik, 1982). Items which are not processed deeply are lost from the system and forgotten (Craik & Tulving, 1975). A form of elaborative rehearsal leading to deeper processing is seen as contrasted with maintenance rehearsal, a rote form of rehearsal which "prolongs an item's high accessibility without leading to formation of a more permanent memory trace (Craik, 1982, p. 12). Items rehearsed by elaborative rehearsal, then, should lead to increased primacy effects, while the results of maintenance rehearsal can be seen in recency.

However, not all serial position studies show clear primacy differences. Marshall, Tate and Anderson (1976), for example, in

their study of learning disabled and normal children ages 7 to 9 years, found no overall differences between learning disabled children and normal children in primacy and recency when analyzed for mean output position and mean probability recall position. It was only after the groups were divided into younger/older groups and primacy analyzed for the mean of the first 4 items and recency for the mean of the last 4 items of an 11 item list that primacy/recency effects were found. Analyzed in this manner, the younger (mean age 7.75) learning disabled children were inferior to normals on both primacy and recency; the older (mean age 9.98) learning disabled children were inferior only in primacy.

While some studies report only poorer primacy for learning disabled children (Bauserman & Orbzut, 1981), others report decreased recency as well as primacy (Cohen & Netley, 1978). These diverse findings have lead to interpretations that learning disabled children may be deficient in elaborative rehearsal as indicated in poorer primacy (Bauer, 1979) or may have weak short-term memory traces as indicated by poorer recency which in turn affects the primacy (Cohen & Netley, 1978). Alternatively, some portion of learning disabled children may be deficient in long-term memory, others in short-term memory, and some in both (Nelson & Warrington, 1980).

In summary, learning disabled children may experience problems only in the primacy portion of recall possibly as the result of elaborative processing. Another view is that poorer primacy may be the result of a deficit in short-term memory. A

third view is that they may experience problems in primacy and/or recency as the result of independent deficits in long and short-term memory.

Encoding

Numerous investigators have found that learning disabled children experience difficulties in encoding verbal information (Cermak, 1981; Cohen & Netley, 1978; Lorsbach, 1982; Perfetti & Goldman, 1976; Vellutino, 1979). However, the exact nature and cause of these difficulties is far from being determined. Much more research is required.

The studies that do exist in this field support two tentative conclusions: learning disabled children do not appear to differ from normal children in the qualitative nature of encoding, and, secondly, the recall of learning disabled children improves as a result of an orienting task which induces active processing. These two areas will be explored in this section. As noted in the previous discussion of developmental findings, there is overlap between strategic and encoding studies.

What attributes do learning disabled children use to encode information? There is little information here.

Direct investigation of attribute encoding appears to have been carried out only in the area of auditory/visual modality of presentation information. This area has possibly been singled out because of the oft debated idea that learning disabled children may experience learning problems specifically linked to modalities (Ceci,

Lea & Ringstrom, 1980; Lerner, 1976). Studies investigating modality encoding report that learning disabled children do encode auditory/visual modality features (Lehman & Brady, 1982; Nelson & Warrington, 1980).

Indirect evidence of attribute encoding comes from the study by Lorsbach (1982) which manipulated two levels of word frequency and two levels of categorical relatedness. In this incidental memory study, learning disabled and normal children (mean age 10.8) heard a word and then classified it by category. Recall followed. The word stimuli were varied along the dimensions of frequency of usage and degree of categorical relatedness. The pattern of recall indicated no differences between learning disabled and normal groups in response to the different semantic characteristics of relatedness and frequency. The same pattern of response times was shown as well. Hence, there appeared to be no difference in qualitative encoding in response to the manipulated dimensions. However, there were quantitative differences. For learning disabled children the overall recall was less and overall response times slower.

The second point, that learning disabled children improve recall as a result of orienting tasks requiring active processing, has been investigated with categorical and labelling tasks.

Increases in recall have been shown to result from requiring the children to categorize items as an orienting task prior to recall. Increased recall has followed the categorization of pictures (Dallago & Moely, 1980) and visually presented words (Wong, Wong &

Foth, 1977).

Lewis and Kass (1982) required children in their study to label, that is to speak the names of, pictures and objects. Their study involved 90 children, learning disabled and normal, between the ages of 4 and 9 years. As reviewed by Wheeler and Dusek (1974), the results of labelling studies with normal children have shown that labelling increases the recall of children under the age of 10. Lewis and Kass found no significant difference between learning disabled and average children in recall following the labelling task.

These findings of increased recall following orienting tasks can be regarded as support for the passive learner framework of Torgesen (1977, 1980). That is, when learning disabled children are required to become active in a task, they are more efficient learners.

However, evidence also suggests that it is not activity per se that increases recall, but rather the type of processing involved. In the Dallago & Moely (1980) study, for example, the perceptual classifying task did not result in significantly greater recall, but conceptual classifying, requiring deeper level semantic processing, did. It is possible then, that learning disabled children, in levels of processing model terms, do not process material deeply enough at semantic levels. When they are required to perform an encoding task which forces deeper processing, their recall improves. Additional support for this viewpoint has been discussed in the strategy review section where it was suggested that

lack of elaborative deeper level encoding could explain the results of serial position studies.

Finally, in encoding, it should be noted that studies repeatedly find a slower rate of memory processing in learning disabled children compared to normal children (Ceci, 1982; Lorsbach, 1982; Torgesen, 1980) and also in reading in disabled children (Jackson, 1980; Perfetti & Hogaboam, 1975; Spring & Capps, 1974).

Incidental/Intentional Memory

Intentional/incidental memory comparisons for the learning disabled have centered about studies in selective attention using the selective attention task developed by Hagen (Hagen & Stanovich, 1977). Typically, findings report that normal children are superior to learning disabled children on central but not incidental task recall with a negative correlation between central and incidental recall for the normals and a positive correlation for the learning disabled (Tarver, Hallahan, Kaufman & Ball, 1976). This is interpreted as evidence of lack of attention to relevant stimuli by the learning disabled. However, the findings can be alternatively interpreted as indications of inefficient cognitive processing (Reid & Hresko, 1981). The difficulties in processing may lie in the area of cognitive search strategies which are employed by the child as a result of his/her anticipation of the meaning of the situation based on past experience (Vrana & Pihl, 1980). This relates to deficiencies in organizing and encoding information rather than to inattentiveness.

Measures of incidental/intentional processing not related

to attention are seen somewhat indirectly in studies such as Dallago & Moely (1980) that compare spontaneous recall levels with recall following an orienting task. However, there appear to be no studies that make a direct comparison between the child's spontaneous encoding and his own intentional efforts to encode information following instructions to remember.

Finally, the learning disabled child's failure to learn well under intentional learning conditions at school has been interpreted in terms of personality and motivational factors. However, there is no consistent finding that incentives, such as money, can improve the memory performance of learning disabled children (Torgesen, 1980).

Developmental Lag Hypothesis

One explanation of the learning disabled child's inefficient learning is the maturational or developmental lag theory. Originally based upon neurological development studies, the central point of this theory is that learning disabled children differ in timing from other children rather than quantitatively. They progress through the same developmental sequences as other children, but at a slower rate. Whether or not the slowness of development is related to neurological origins is debated (Lerner, 1976, pp. 321-323).

One possible impact of this slower development on the learning disabled child

> is proposed by Kirk (1967), who sets forth the hypothesis that during the growing stages the child normally tends to perform in those functions that are

> comfortable while avoiding activities and functions that are uncomfortable. Since certain processes have lagged in maturation and are not functioning adequately for the child with learning disabilities, that child avoids and withdraws from activities requiring that process. As a result, that function fails to develop and the deficit area is thereby intensified and exaggerated. (Lerner, 1976, p. 323)

In Kirk's explanation can be seen a source of possible explanation for structural as well as functional sources of learning disability deficit. Relative to his/her chronological age, the learning disabled child may have structural defects. Since structure determines strategic choices (Hunt, 1980), the strategies may also appear deficient. In later years, when structure has sufficiently developed to allow a more advanced strategic behaviour, the learning disabled child may not use the more advanced strategies for the reasons advanced by Kirk. This would explain, for example, the strategic deficiencies that appear with learning disabled children in categorization studies (eg. Wong, Wong & Foth, 1977), even though they possess sufficient cognitive skill in categorization.

General support for the developmental lag theory has come from the longitudinal study work of Satz (Satz, Friel & Rudegeair, 1974).

Support from memory research has come specifically in the areas of voluntary, strategic memory (Ceci, 1982) and verbal rehearsal and selective attention (Tarver et al, 1976; Tarver & Ellsworth, 1980). As previously noted, Ceci found 10 year old learning disabled children to perform like 4 year old normal children on strategic memory tasks. The studies in verbal rehearsal

and attention compared the recall of learning disabled and normal children in grades 1, 3, 5 and 7 in one study (Tarver & Ellsworth, 1980) and ages 8, 10 and 13 in the other (Tarver et al, 1976). Findings here suggest a developmental delay of about two years in the area under study.

Summary of learning disabled memory studies

A number of studies have demonstrated that with both auditory and visual stimuli, learning disabled children experience problems with verbal processing as measured by free recall.

When learning disabled children perform an orienting task, it improves their recall. The orienting task results from the studies reviewed lend themselves to two interpretations: one, the task has improved recall by guiding strategic behaviour; two, the task has improved recall by inducing processing to greater depth. In either case, there is evidence that the learning disabled child is inefficient in memory processes and fits the "passive learner" conceptualization of Torgesen (1977, 1980).

What accounts for the memory difference between learning disabled and normal children? One theory discussed was the developmental lag theory. While the studies reviewed in the area of strategic behaviour indicated strategic deficits for learning disabled children, the consistent findings that speed of processing is slower for learning disabled children makes it very unlikely that strategic differences alone can account for memory differences (Wong, in press). What is more likely is some, as yet not

understood, interaction between structural capacity and strategic choice (Cohen & Netley, 1978; Hunt, 1980; Torgesen, 1980).

Although the incidental/intentional distinction is an important one in Torgesen's conceptualization of the learning disabled child as a passive learner, there is a lack of memory studies that make this comparison.

As reviewed in this section, various studies (Dallago & Moely, 1980; Lorsbach, 1982; Wong, Wong & Foth, 1977) have indicated that learning disabled children do not appear to differ from normally achieving children on the qualitative aspects of memory encoding. While evidence suggests that learning disabled children do not spontaneously organize themselves effectively for recall, the use of active orienting tasks, such as categorizing, can improve their recall (Dallago & Moely, 1980; Wong, Wong & Foth, 1977).

Both the similarity to normal children of qualitative encoding and the ability of learning disabled children to respond to an active categorical orienting task suggest that active orienting tasks may be an effective means of improving the memory of learning disabled children. The present study, as will be more fully explained in chapter 3, will extend the study of orienting tasks to an active generating task developed by Slamecka & Graf (1978). The use of this task under both incidental and intentional learning conditions will permit an interactive study of the active orienting task under incidental and intentional conditions with both learning disabled and normally achieving children.

CHAPTER 3

RATIONALE, DEFINITIONS, HYPOTHESES

Rationale

Independent Variables

All independent variables have been selected for their relationship to the active passive concept: learning disabled children, because of their designation as passive learners; normally achieving children, because of their designation as active learners; read and generate tasks because of the active/passive distinction in the type of processing required for these tasks; and incidental and intentional learning conditions because of the active/passive distinction here in efforts to organize for recall.

Read/Generate

As described by Bower and Hilgard (1981), learning theory for many years has been concerned with "active responding" believing strongly that

> people learn best by actively manipulating the learning material, responding to it, and relating one part to another. Guthrie, Thorndike and Skinner have emphasized active responding. People are most likely to learn from text if they ask questions about it, then search the text for answers, then actively recite the answers to themselves. A number of verbal experiments (eg. Bobrow & Bower, 1969; Slamecka & Graf, 1978) have shown that adults better remember information that they have had to connect actively in some prescribed way. (p. 539)

In other words, tasks which require the individual to

actively question, actively recite, actively connect, and actively generate a response are seen as contrasted with tasks such as passively reading or hearing material.

The effort of orienting tasks which require active processing upon memory has been studied with both learning disabled and normal children. Such tasks have been shown to increase recall in normal children (Belmont & Butterfield, 1977). While not as widely studied with learning disabled children, limited study with categorical and labelling orienting tasks suggests that these "active" tasks increase the recall of learning disabled children (Dallago & Moely, 1980).

This study will use as an "active" task the generate task; as a "passive" processing task, the read task. These read/generate tasks are based upon the work of Slamecka and Graf (1978). These tasks have been chosen because (1) Slamecka and Graf found the generate tasks to consistently increase recall across a number of conditions such as timed and subject paced, incidental and intentional, and within and between subject designs; (2) the read/generate task, as developed by Slamecka and Graf employs identical words for both read and generate conditions so that an unbiased measure is obtained of active and passive processing (Slamecka & Graf, p. 539); (3) the read/generate task selected minimizes, although does not eliminate, some of the potential confounding factors such as extensiveness of cognitive schema, educational experience, and out of classroom experience between the learning disabled and normal children; (4) a series of experiments have

demonstrated that the generation effect is specifically concerned with semantic (verbal) processing (McElroy & Slamecka, 1982). This is important because it has been demonstrated that the memory problems of learning disabled children are concerned with verbal processing (Cermak, 1981; Cohen & Netley, 1978; Lorsbach, 1982; Perfetti & Goldman, 1976; Vellutino, 1979).

Slamecka and Graf used a variety of word materials in the read/generate tasks. For the purpose of this study one has been selected which involves the use of opposite word pairs. The task, then, requires the subject to either read opposite word pairs or generate the second word of an opposite word pair.

Incidental/Intentional

The theoretical importance of an incidental/intentional memory comparison for normal children has been discussed by Flavell (1977) and Brown (1975). Such a comparison would be expected to yield information concerning the child's memory organization, the type of organizational strategies that are used spontaneously contrasted with those used intentionally, as well as allowing for a qualitative and quantitative memory comparison under the two learning conditions. Studies with selective attention tasks show greater intentional recall with age (Tarver et al, 1976).

The theoretical importance of the incidental/intentional distinction in regard to learning disabled children has been discussed in Chapter 2. Briefly, the learning disabled child has been described by Torgesen (1978, 1980) as average or above in

incidental learning, as measured by IQ, but deficient in intentional learning as measured by school achievement. Evidence of lack of strategic skill, interpreted by some as evidence of lack of purposeful, intentional, goal-directed learning (Dallago & Moely, 1980), has been demonstrated (eg. Wong, Wong & Foth, 1977). However, strategic studies impose strategies which are thought to interfere with the child's own strategic behaviour (Brown, 1975; Lorsbach, 1982). This study will present the same type of task twice, under incidental conditions the first time and under intentional conditions the second. There will be nothing present in the incidental condition that is not also present in the intentional condition. This should allow for a view of the comparison of incidental and intentional memory effects upon both learning disabled and normally achieving children as well as a comparison of the relative effects upon memory of the two conditions for the two groups of children. Additionally, both active and passive orienting tasks will be given to each child under both incidental and intentional learning conditions. This gives an opportunity to examine the interaction between the active/passive orienting tasks, as exemplified in the generate/read conditions with incidental and intentional efforts to learn.

Learning Disabled/Normally Achieving

As described in Chapter 2, the main theme in contemporary developmental literature is that as the child develops, s/he is seen as increasingly active in his/her attempts to remember (Hagen, et al,

1975). Thus, active participation in memory tasks, often studied in terms of strategies, is seen as an important component in efficient memory (Torgesen & Kail, 1980). Normally achieving children have been included in this study because (a) the read/generate task of Slamecka and Graf has not previously been done with children and it is necessary to have a baseline of normal behaviour on this task with which to compare that of the learning disabled children and (b) little is known of the effects of incidental versus intentional conditions upon the memory processing of children. Again, normally achieving children are needed to provide a basis of comparison.

In contrast to the active designation of the normal child, the learning disabled child is termed passive (Torgesen, 1977, 1980). Various studies have demonstrated that learning disabled children are inefficient when required to actively plan and carry out memory tasks (Dallago & Moely, 1980). However, it is not clear why learning disabled children are inefficient, nor along what dimensions their memory processing differs from that of normally achieving children. This study will combine the examination of an active orienting task with incidental and intentional conditions.

The ages selected for study with the normally achieving children are 9 and 10 years of age. This age group is selected because (a) children in this age range are regarded as possessing a working, flexible repertoire of mneumonic strategies (Hagen, Jongeward & Kail, 1975; Kail, 1979; Tarver, Hallahan, Kauffman & Ball, 1976), (b) the age group permits comparison with the research populations of related studies (Dallago & Moely, 1980; Lewis & Kass,

1982; Lorsbach, 1982; Wong, 1978) and (c) this age group permits a match with learning disabled children who have been identified by school personnel as learning disabled. The significance of this latter point was discussed in Chapter 2 (pp. 18-19).

Two age groups have been selected for study with the learning disabled children. The younger group, 9 and 10 years of age, will permit a memory comparison between learning disabled and normally achieving children on the most frequently used match of chronological age. An older age group, 11 and 12 years of age, will permit two comparisons: (a) a match with the normally achieving children on the basis of reading age (Bradley & Bryant, 1981) and (b) a chronological age comparison in accordance with the developmental lag hypothesis (Lerner, 1976) with the younger learning disabled group who are, on the average, 2 years younger.

Dependent Variables

Recall

Free recall has been selected as the dependent variable because free recall is considered to be sensitive to strategic development (Kail, 1979) and a sensitive measure of organization (Herriot, Green & McConkey, 1973). All the studies reviewed in Chapter 2 used free recall as their memory measure.

Definitions

Read Condition

The subjects are required to read aloud the presented word

pairs.

Generate Condition

The subjects are required to read aloud the first word of the pair, but supply the second word using as a clue the presented first letter of the second word (eg. up d---).

Incidental Condition

The subjects are informed only of the experimental task; they are not informed of the recall task to follow. That is, subjects are informed of the read and generate tasks only.

Intentional Condition

Subjects are informed of the recall task as well as the experimental task. That is, subjects are informed of the recall task which will follow their performance of the read and generate tasks.

Normally Achieving Children

Normally achieving children are 9 and 10 years of age. For further definition, see Chapter 4.

Learning Disabled Children

Learning disabled children are divided into two age groups: 9 and 10 years of age; 11 and 12 years of age. For further definition, see Chapter 4.

Hypotheses

Hypothesis 1

The total mean recall of 9 and 10 year old normally achieving children will be greater than the total mean recall of the 9 and 10 year old learning disabled children.

Hypothesis 2

The total mean recall for the generate condition will be greater than the total mean recall for the read condition.

Hypothesis 2-1

The total mean recall of normally achieving children will be greater in the generate condition than in the read condition.

Hypothesis 2-2

The total mean recall of 9 and 10 year old learning disabled children will be greater in the generate than in the read condition.

Hypothesis 2-3

The generate condition will result in greater recall in both incidental and intentional conditions for the normally achieving children.

Hypothesis 2-4

The generate condition will result in greater recall in both incidental and intentional conditions for the 9 and 10 year old learning disabled children.

Hypothesis 3

There will be greater recall under intentional as compared

to incidental conditions for both learning disabled and normally achieving 9 and 10 year olds.

Hypothesis 3-1

The intentional condition, as compared to the incidental condition, will result in proportionately greater recall for the normally achieving than for the learning disabled 9 and 10 year olds.

Hypothesis 4

The total mean recall of 11 and 12 year old learning disabled children will be greater than the total mean recall of the 9 and 10 year old learning disabled children.

Hypothesis 4-1

The mean recall of 11 and 12 year old learning disabled children will be greater than the mean reall of the 9 and 10 year old learning disabled children in every condition.

CHAPTER 4

METHOD

Subjects

The sample studied consisted of 20 normally achieving children and 20 learning disabled children. The normally achieving children were selected from two classrooms in an elementary school from within the St. Albert Protestant Separate School District. The learning disabled children were from the Junior and Senior Adaptation classes and the Severely Disabled class in the St. Albert Protestant Separate School District.

The criteria for the selection of normally achieving were:

1. Achievement at reading levels no greater than one-half year below their grade placement and not more than one year above grade placement as measured by results obtained on the Metropolitan Achievement Test administered in September, 1982.
2. Grade placement commensurate with their chronological age. That is, they had neither failed nor "skipped" a grade.
3. They were judged by their classroom teachers to be normally achieving.
4. English was their first language.
5. They had no record of emotional, behavioural, or learning problems. They had no record of a physical handicap such as hearing impairment.

The fulfilment of these requirements was ascertained by:

1. The examination of Metropolitan Achievement Test scores.
2. The examination of school cumulative records.
3. Discussions with classroom teachers, the counsellor, and the resource room teacher.

Based on the above criteria, children were excluded from the study because:

1. Their Metropolitan Achievement Test scores were either too high or too low.
2. English was not their first language.
3. They had repeated a grade.
4. They had a history of emotional/behavioural problems.
5. They had received special assistance at some time in the past from the resource room teachers.

The twenty children included in the study represent children who satisfied the above criteria and for whom it was also possible to obtain parental consent. The normally achieving children were all 9 and 10 years of age.

The criteria of the St. Albert Protestant Separate School District for placement in Junior Adaptation, Senior Adaptation, and Severely Disabled classes include:

1. An IQ of at least 90 on an individual intelligence test administered not more than 12 months prior to placement.
2. Serious difficulties in the core subjects such as reading and arithmetic as judged by at least a two year deficit in expected grade level achievement as measured by Metropolitan Achievement

Test results.

3. While children may have secondary emotional/social problems, these are not judged to be the primary reason for academic difficulties. Prior to special class placement, each child receives an extensive assessment by the school psychologist or counsellor that includes intellectual assessment (eg. Weschler Intelligence Scale for Children - Revised), diagnostic subject assessment (eg. Stanford Diagnostic Reading Test) and process related assessment (eg. Illinois Test of Psycholinguistic Abilities).

4. Children are not physically handicapped.

5. Children are placed in these classrooms as a result of continuing academic difficulty which has not responded to other forms of assistance such as resource room placement.

For the purposes of this study, the fulfilment of these criteria was ascertained by:

1. Discussion with school personnel concerning the qualifications for placement and the placement procedures.

2. Examination of IQ scores.

3. Examination of cumulative records of one of the special classes (ten students).

The 20 learning disabled children included in this study represent the entire population of 9 to 12 year old children in the three special classes who obtained parental consent. The 20 children were divided into two groups: a younger group, ages 9 and 10

which matched the normally achieving group in chronological age, and an older group, ages 11 and 12, which matched the normally achieving group in reading level.

The measure of reading level was the reading subtest for the Metropolitan Achievement Test (1971), the achievement utilized by the school district for yearly assessment of its students. The split-half reliability for the reading subtest of the Matropolitan Achievement Test at the Primary I Level (Grades 1.5 - 2.4) is .95, at the Primary II Level (Grades 2.5 - 3.4) is .93, at the Elementary Level (Grades 3.5 - 4.9) is .92, and for the Intermediate Level (Grades 5.0 - 6.9) is .93 (Metropolitan Achievement teacher's handbooks for each level as reported by Salvia and Ysseldyke, 1978).

The mean IQ of the 20 learning disabled children was 98.71 (sd 8.19) as measured by the Weschler Intelligence Scale for Children - Revised (WISC-R) or the Stanford-Binet Intelligence Scale for Children. There were no intelligence scores available for the normally achieving children because of school policy.

Sample characteristics of the normally achieving and learning disabled groups were as follows:

Table 1

Sample Mean Chronological and Reading Age

	Chronological Mean	Reading Mean
Normally Achieving (N = 20)	9.68	4.74
Learning Disabled (N = 10)	9.94	2.18
Learning Disabled (N = 10)	11.89	3.96

Table 2

Sample Characteristics

Sample	Age in Months		Reading Level in Years	Range
Normally Achieving N = 20	$\bar{x}$ = 116.20 sd = 5.71	(9.68 yrs.) (range 9-2 to 10-11)	$\bar{x}$ = 4.74 sd = .68	4.1 to 5.9
Learning Disabled (younger) N = 10	$\bar{x}$ = 119.30 sd = 6.93	(9.94 yrs.) (range 9-2 to 10-11)	$\bar{x}$ = 2.18 sd = .55	1.9 to 3.0
Learning Disabled (older) N = 10	$\bar{x}$ = 142.70 sd = 6.36	(11.89 yrs.) (range 11-1 to 12-8)	$\bar{x}$ = 3.96 sd = 1.38	2.2 to 6.2

A Scheffe comparison of age means showed that while 9 and 10 year old learning disabled and normally achieving children did not differ from one another, the 11 and 12 year old learning disabled group differed significantly at the .05 level of significance from the other two groups.

A Scheffe comparison of reading level means showed that at the .05 level of significance, the 11 and 12 year old learning disabled and 9 and 10 year old normally achieving groups differed significantly from the 9 and 10 year old learning disabled group, but did not differ from each other in reading level.

In summary, there are three groups, a normally achieving group and two learning disabled groups. One of the learning disabled groups is a chronological age match for the normal group; the other, a reading match.

Materials

A word pool of 28 word pairs of opposites (eg. up down) was drawn up. In selecting the word pairs three main factors were considered: readability, frequency of usage, and degree of conceptual difficulty involved in generating the opposite when supplied with one word of the pair. Thus, to maximize readability, words were chosen from core reading vocabulary lists at the pre-primer and primer levels for St. Albert Protestant Separate schools. Additionally, words were also selected from the Dolch Basic Sight Word list. In consideration of equivalent frequency, all selected words were rate as AA (high frequency) by Thorndike and Lorge (1944).

Conceptual difficulty was checked for as many word pairs as possible by comparison with the ranking of the word opposite pairs in Test 5 of the Detroit Tests of Learning Aptitude.

Word pairs were randomly assigned to two lists: List A (incidental) and List B (intentional). The order of word pairs within lists was randomly determined.

Word pairs were typed in PICA type on white 3" by 5" file cards. For the read condition, both of the opposite word pair were printed on the card (eg. up down). For the generate condition, the first word of the word pair was printed on the card, but only the first letter of the second word with an appropriate number of dashes typed to indicate the remainder of the word (eg. up d---).

An additional seven word pairs were selected for use as demonstration items. Demonstration items were also typed on 3" by 5" cards.

As a result of the pilot study, four demonstration word pairs were replaced. As well, four word pairs were deleted from the test items (see p. 54), resulting in 12 word pairs for each of the incidental and intentional conditions. The frequency of word pair recall was calculated for each list and the word pairs were redistributed between List A and List B on the basis of frequency of recall within list divisions of primacy, recency, and mid-list position. See Appendix A for the word lists for both the pilot and the longer study.

Pilot Study

A pilot study was conducted in a semi-urban elementary school. The purpose of the pilot was to test blocked versus unblocked read/generate conditions, to test the adequacy of instructions, and to monitor the ease with which children were able to both read and generate the required words.

Consent forms were distributed to two grade five classrooms. The teachers divided the children who gained parental permission into three groups on the basis of reading ability: low (approximately one year below grade level); average (at grade level; and high (two years or more above grade level). For the purposes of the pilot, high and average readers were combined into one group of good readers. This meant there were two groups, good and poor readers, with eight in each group. The good and poor readers were randomly assigned to blocked and unblocked read/generate conditions. Within the blocked condition, the order of read and generate was counterbalanced between subjects.

Table 3

Pilot Subject Distribution

	Blocked Condition		Unblocked Condition
	Read-Generate	Generate-Read	
Good readers	2	2	4
Poor readers	2	2	4

The average age of the children was 10.6 years with a range of 10-1 to 11-11.

Subjects were seen individually in a room apart from their classroom. For the incidental condition, each subject was told that they were going to be shown some cards with opposites printed on them. Some of the time they would just be required to read the opposites out loud; some of the time they would read the first word of the opposite out loud, but would be required to supply the missing second word using the first letter as a clue. They were then given the demonstration items. After completing these items, they were told that they now know what to do and List A words were presented at a subject paced rate. Immediately following completion of the list, subjects were requested to say all the opposites they could remember. Two minutes were allowed for recall. Following recall, subjects were told they were going to do the same thing over again; they were going to read and think of opposites and at the end would be asked to recall all of the words they could remember. This intentional condition, List B, was also subject paced. At the conclusion subjects were again asked to recall.

Word pairs were tape recorded and also written down on the test protocol.

The mean recall results can be seen in Table 4. It can be seen that while mean recall for both poor and good readers was greater in the generate than read condition, the difference was greater for good readers. Results of a one-tailed correlated t-test show that the generate condition resulted in significantly more

Table 4

Mean Recall Results for Pilot Study

	Incidental		Intentional		Total	
Group	Read	Generate	Read	Generate	Read	Generate
Good readers	1.75	2.63	.88	2.63	2.63	5.25
Poor readers	1.63	2.13	1.63	2.25	3.25	4.38

recall than the read condition for good readers at $< .05$ level of significance ($t = 2.52$). A one-tailed correlated t-test showed that the generate condition resulted in more recall than the read condition for poor readers at $< .10$ level of significance ($t = 1.52$).

T-tests of blocked/unblocked lists showed greater recall in blocked conditions for intentional lists ($t = 1.82$, $p < .05$).

In summary, both good and poor readers benefitted from the generate condition, although good readers benefitted more.

As a result of the pilot findings, it was decided to use blocked read/generate conditions in the study. As previously mentioned, demonstration word pairs were replaced with easier items. Four word pairs were dropped from the test lists because some students had experienced some difficulty either reading them or generating the required opposite. For example, "big l-----" was dropped because some students generated "large" rather than "little". Also, on the basis of group average time to respond to items as well as the individual differences in response times demonstrated by maximum and minimum times, a pacing rate of three seconds per word pair was judged an appropriate rate.

Design

The design was a 2 x 2 x 2 factorial design. The dependent variable was recall. The three independent variables were normally achieving/learning disabled (between subjects); generate/read (within subjects); and incidental/intentional (within subjects).

Because of the blocked read/generate condition, the order

of read and generate was counterbalanced across subjects within each of the three groups, older learning disabled, younger learning disabled, and normally achieving. The same order was followed for incidental (List A) and intentional (List B) conditions.

Procedure

Each child was seen individually in a room apart from the regular classroom. The experimental sequence is fully described in Appendix B.

Each child was seated at a table and asked "Do you know what an opposite is?" S/he was then shown demonstration card #1 with the words "fat thin" printed on it with appropriate drawings of a fat person and a thin person above the words. (Demonstration card #1 was the only illustrated word pair.) While displaying the card, the examiner spoke the words "the opposite of fat is thin". The examiner continued "the opposite of dirty is (pause) clean (#2). I am going to show you some cards with opposites printed on them. Some of the time you will just need to read the opposites out loud. Like this (display card #3)." Child and examiner read the word pair aloud. "Some of the time you can read the first word of the opposite, but just the starting letter of the other word will be there. Then you need to think of what the missing word is and say it out loud. Like this (display and read demonstration card #4). Let's practice a few (display and read demonstration cards #5, #6 and #7)". (See Appendix A for word list) The examiner supplied help if the child required it.

At the conclusion of the presentation of the demonstration cards, the examiner said, "Okay, you know what to do." Cards from List A (incidental condition) were then held about six inches in front of the child and displayed one at a time. Each card was shown for three seconds. Time was kept by a digital pen inconspicuously placed on the table with the numbers facing the examiner not the subject. If the child was unable to read a word the word was supplied for him/her. In the generate condition, if the child had not generated the required word by the end of 3 seconds, the word was supplied for him/her. Records were kept of words supplied because of a failure to either read or generate.

At the conclusion of the incidental list, the subject was instructed to recall with the words, "Now tell me all the words you can remember that you have just said out loud. Tell me all the opposites you can remember." Responses were written by the examiner in the test protocol and also recorded by cassette tape recorder. Ninety seconds were allowed for recall. Encouragement such as "good" was given after the first few responses and "can you think of any more" at the conclusion (provided there was still time).

The presentation of List B (intentional) was carried out in the same manner as List A (incidental condition). Instructions were, "Now we're going to do the same thing over again. You are going to read some opposites from cards. Then, at the end, tell me all you can remember". List B was then given in the same manner as List A. At the conclusion of the list, the child was asked to say all the opposites s/he could remember. Responses were written in

the test protocol and recorded.

In scoring the protocols, credit was only given if both words of the opposite word pair were recalled. In fact, in all cases but one item, recall was of the word pair. Substitutions such as "hi" for "hello" were not credited.

CHAPTER 5

RESULTS

Hypotheses 1 - 3 inclusive were tested utilizing a 2 (groups) x 2 (read/generate conditions) x 2 (incidental/intentional conditions) analysis of variance. The groups were a between factor; generate/read and incidental/intentional conditions were both within factors. The ANOVA results are shown in Table 5.

Hypothesis 1 states that the total mean recall of the 9 and 10 year old normally achieving children will be greater than the total mean recall of the 9 and 10 year old learning disabled children. Total mean recall over all conditions for the normally achieving children was 6.65 and for the learning disabled, 4.4. As indicated in Table 5, this difference in total recall is a significant one, $F\ (1, 28) = 6.099$, $p < .05$. These results support Hypothesis 1.

Hypothesis 2 states that the total recall for the generate condition will be greater than the read condition collapsed over groups and the incidental/intentional conditions. As indicated in Table 5, the ANOVA results show no significant main effect for the read/generate condition. Therefore, Hypothesis 2 is not supported.

Hypothesis 2-1 states that the recall of normally achieving children in the generate condition will be greater than in the read condition. Similarly, Hypothesis 2-2 states that the recall of 9 and 10 year old learning disabled children will be greater in the

Table 5

ANOVA for Recall of

9 and 10 year old normally achieving and learning disabled

Source	df	MS	F
Between			
- Groups	1	8.438	6.099 *
- Error	28	1.383	
Within			
-Incidental/Intentional Condition	1	1.504	1.466
-Groups x Incidental/Intentional	1	1.504	1.466
-Error	28	1.026	
Within			
- Read/Generate	1	0.504	0.434
- Groups x Read/Generate	1	7.704	6.630 *
- Error	28	1.162	
Within			
- Read/Generate x Incidental/Intentional	1	2.204	2.568
- Groups x Read/Generate x Incid./Inten.	1	0.337	0.393
- Error	28	0.858	

n = 30

$* \; p < .05$

generate condition. The ANOVA results (Table 5) indicate a significant interaction between groups and the read/generate conditions, $F(1, 28) = 6.630$, $p < .05$. The nature of this interaction was analyzed by the use of correlated tests. Correlated t-tests using a two-tailed probability level showed that the generate condition resulted in significantly greater recall for normally achieving children, $t(19) = 2.55$, $p < .05$. Correlated t-tests using a two-tailed probability level showed no significance between read and generate conditions for 9 and 10 year old learning disabled children. Therefore, Hypothesis 2-1 is supported: the generate condition does result in significantly better recall than the read condition for normally achieving children. However, there was no significant difference in recall in the generate and read conditions for learning disabled 9 and 10 year olds. Hypothesis 2-1, but not 2-2, is supported.

Hypothesis 2-3 states that for normally achieving children, the generate condition would result in greater recall than the read condition in both incidental and intentional learning conditions. The results of a correlated t-test performed on the means of the generate and read conditions for the incidental condition showed significantly greater recall for generate, $t(19) = 2.74$, $p < .01$ using a two-tailed test. The results of a correlated t-test performed on the means of the generate and read conditions for the intentional condition showed no significant difference between read and generate, $t(19) = 1.31$. Thus, while the generate condition results in greater recall than read in the incidental condition, it

does not in the intentional condition. This does not agree with the Slamecka and Graf (1978) and McElroy and Slamecka (1982) results with adults which report greater recall for intentional as well as incidental conditions.

Hypothesis 2-4, which states that for the 9 and 10 year old learning disabled children the generate condition will improve recall in both intentional and incidental conditions, is not supported because, as already discussed, generate does not result in greater recall for the learning disabled group.

Hypothesis 3, predicting superior recall for both groups in intentional over incidental conditions, and Hypothesis 3-1, predicting proportionately greater benefit for normal children from the intentional condition, are not supported by the ANOVA results which show no significant main effects for the incidental/intentional conditions and no interactive effects between groups and incidental/intentional conditions (Table 5). Neither group benefit significantly from the intentional learning condition.

Hypothesis 4 was tested utilizing a separate analysis of variance. A 2 (groups) x 2 (read/generate conditions) x 2 (incidental/intentional conditions) analysis of variance was used for the comparison of the two learning disabled groups. Table 6 reports the results of this analysis.

Hypothesis 4 states that the total mean recall of the 11 and 12 year old group will be greater than the total mean recall of the 9 and 10 year old learning disabled group. As indicated in Table 6, the total mean recall of the older group was significantly

Table 6

ANOVA for differences in recall

for two learning disabled groups

Source	df	MS	F
Between			
- Groups	1	4.513	6.699 *
- Error	28	0.674	
Within			
- Incidental/Intentional Condition	1	1.512	2.139
- Groups x Incidental/Intentional	1	1.512	2.139
- Error	18	0.707	
Within			
- Read/Generate Condition	1	0.313	0.332
- Groups x Read/Generate	1	1.512	1.609
- Error	18	0.940	
Within			
- Read/Generate x Incidental/Intentional	1	1.012	1.389
- Groups x Read/Generate x Incid./Inten.	1	0.613	0.840
- Error	18	0.729	

$n = 20$ $\quad$ * $p < .05$

greater than that of the younger group, $F(1, 18) = 6.99$, $p < .05$. As shown in Table 7, in every condition the mean recall of the 11 and 12 year olds was greater than the mean recall of the 9 and 10 year olds. Of particular interest is the finding that for the older, but not the younger, learning disabled group: (1) the generate mean recall is greater than the read mean recall and (2) the intentional mean recall is greater than the incidental mean recall. However, as reported in Table 6, these results are not statistically significant. In summary, the ANOVA results support Hypothesis 4. Total mean recall is greater for the older age group of learning disabled children. The ANOVA results show no significant differences between the groups in the different conditions. Therefore, Hypothesis 4-1 is not supported.

Serial Position Analysis

An analysis of serial position was carried out in accordance with standard memory procedures. As described by Herriot (1974),

> The serial position curve is obtained by plotting the probability of a particular item being correctly recalled along the ordinate, and the item's position in the sequence of items presented along the abscissa... Typically, there is a primacy effect - subjects are more likely to recall the early items of the series; and there is a recency effect - the last few items are also better recalled. The asymptote is reached with the middle items; the longer the list, the more items fall along the asymptote (Murdock, 1962). In other words, primacy and recency effects are limited to the first and last few items of the list, however long it is. (p. 159)

Table 7

Summary of Mean Recall for Groups and Conditions

Group	Read	Generate	Incidental	Intentional
Normally Achieving N = 20	2.65	4.00	2.85	3.80
Learning Disabled (younger) N = 10	2.70	1.80	2.20	2.20
Learning Disabled (older) N = 10	3.00	3.30	2.60	3.70

A significant finding in the serial position analysis was the presence of two serial position curves within the 12 item list (Figures 1, 2). These curves correspond to the miniature within list serial position curves described by Murdock and Carey (1972) in their study of release from interference in single-trial free recall. Their explanation of the relationship of serial position and interference effects is "it seems reasonable to assume that one should find a recency effect within blocks due to the reduction of RI consequent on change of category. Also, one should find a primacy effect due to the release from PI" (p. 308). As can be seen in Figures 5 and 6, each 12 item list has two miniature curves that correspond to the two different conditions, read and generate. For purposes of this comparison, the position curves of the two age groups of learning disabled children were collapsed into one group as it was found that the two learning disabled groups were very similar.

In all four within-list curves, there is a recency effect for both learning disabled and normally achieving children. However, for both groups primacy effects appear weaker. In general, then, there is evidence of a recency effect for both groups, but reduced primacy effect.

This pattern is similar to that found for both normal (Butterfield, Siladi & Belmont, 1980; Ornstein & Nauss, 1978) and learning disabled (Newman & Hagen, 1981) children with age groups comparable to those of the present study. It should be noted that

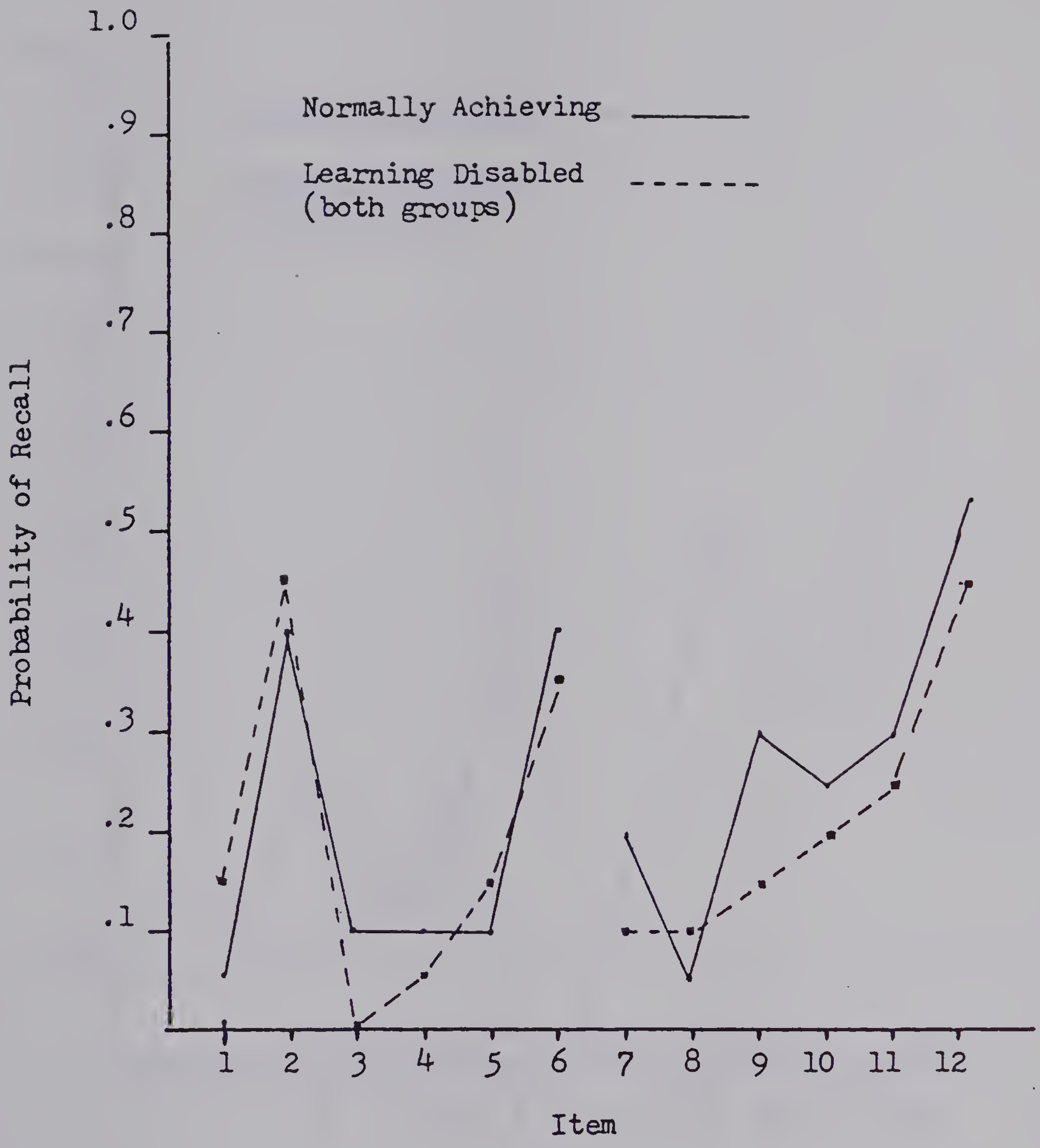

Figure 1

Item Probability of Recall
For the Incidental Condition

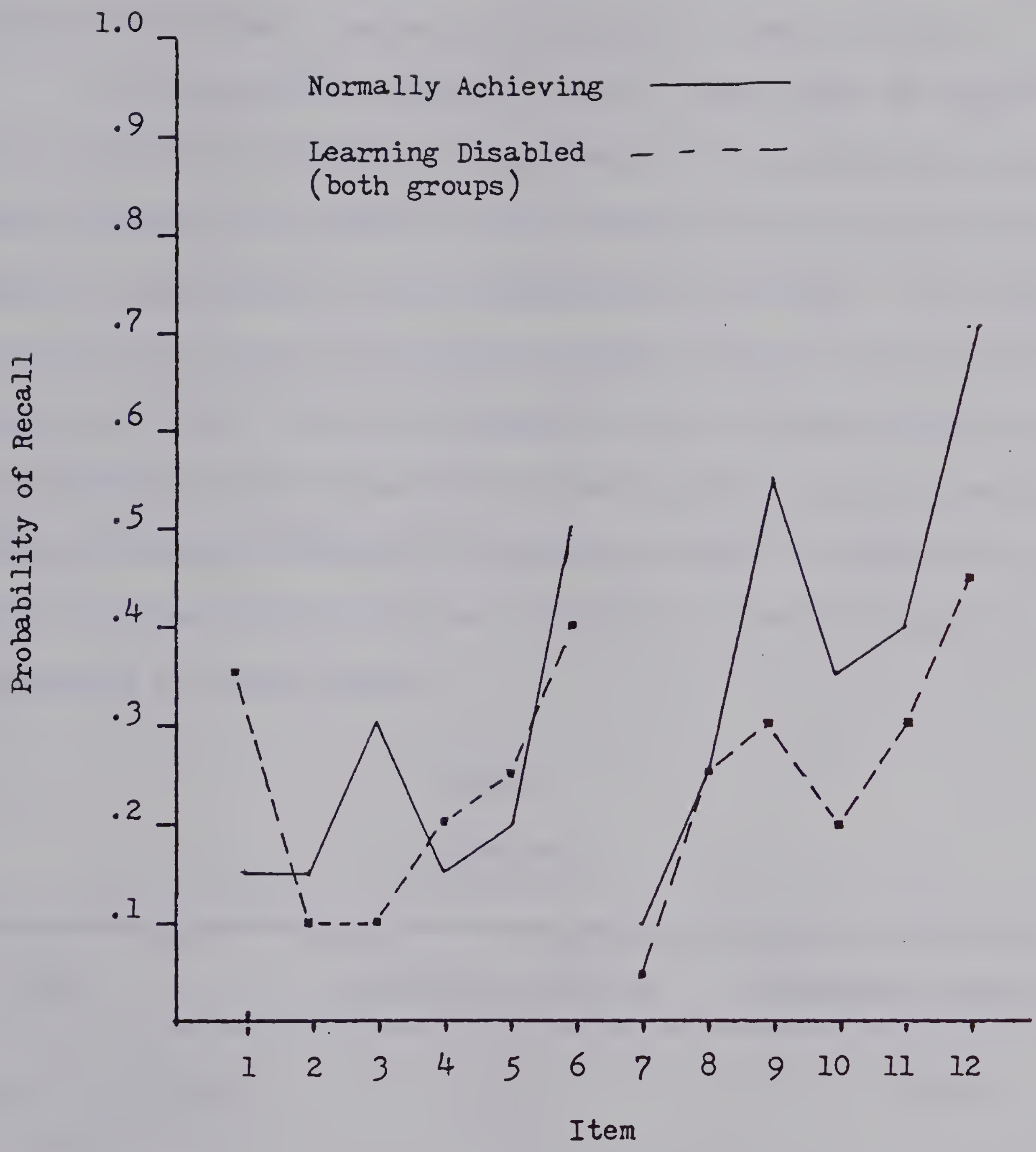

Figure 2

Item Probability of Recall
For the Intentional Condition

serial position analysis is somewhat distorted by item 2 in the incidental list which is a distinctive noun pair (mother father) opposite and follows a weaker adverb pair (up down) in item 1.

As can be seen in Figures 1 and 2, item 6 has the highest recall probability of the first six items, while probability recall falls off sharply for item 7. These items mark the position of the change in presentation for the read/generate conditions. The first six items were given to the child in either the read or the generate condition; items 7 to 12 were presented in the alternate condition. The difference between items 6 and 7 was calculated proportionately using the formula probability of recall for item 6 - probability of recall for item 7 divided by the probability of recall of item 6. The results are shown below.

Table 8

% Release

Group	Incidental condition	Intentional condition
Normally Achieving n = 20	55.50	80.00
Learning Disabled	71.40	87.50

Both groups show an increase in release under intentional conditions. The learning disabled children show a higher % of release than the normally achieving group.

In summary of the release data, both learning disabled and normally achieving children show similar patterns of response with marked recency effects for the last item within each six item read/generate condition (Items 6, 12). This is true of both incidental and intentional conditions. The learning disabled group shows somewhat greater release effects than the normally achieving group. One possible explanation of this data is that a change in processing can cause a reduction in retroactive interference in this paradigm.

A serial position analysis was also carried out by calculating the mean output position. The correctly recalled items from each response protocol were analyzed for their output positions (ie. first, second, third, etc.). These results are shown in Figures 3 (Normally achieving children) and 4 (Learning disabled children) with mean output position a function of input serial position.

The incidental condition list for normally achieving children indicates a recency effect with items from the final portion of the list retrieved first. There is an indication of a reduced primacy effect with initially presented items retrieved somewhat ahead of middle list items.

The mean output position for normally achieving children in the intentional condition again shows a recency effect. The primacy effect here appears somewhat stronger than in the incidental condition with the first two presented items very close in mean output position to the last two items. Again, mid-list items are retrieved last.

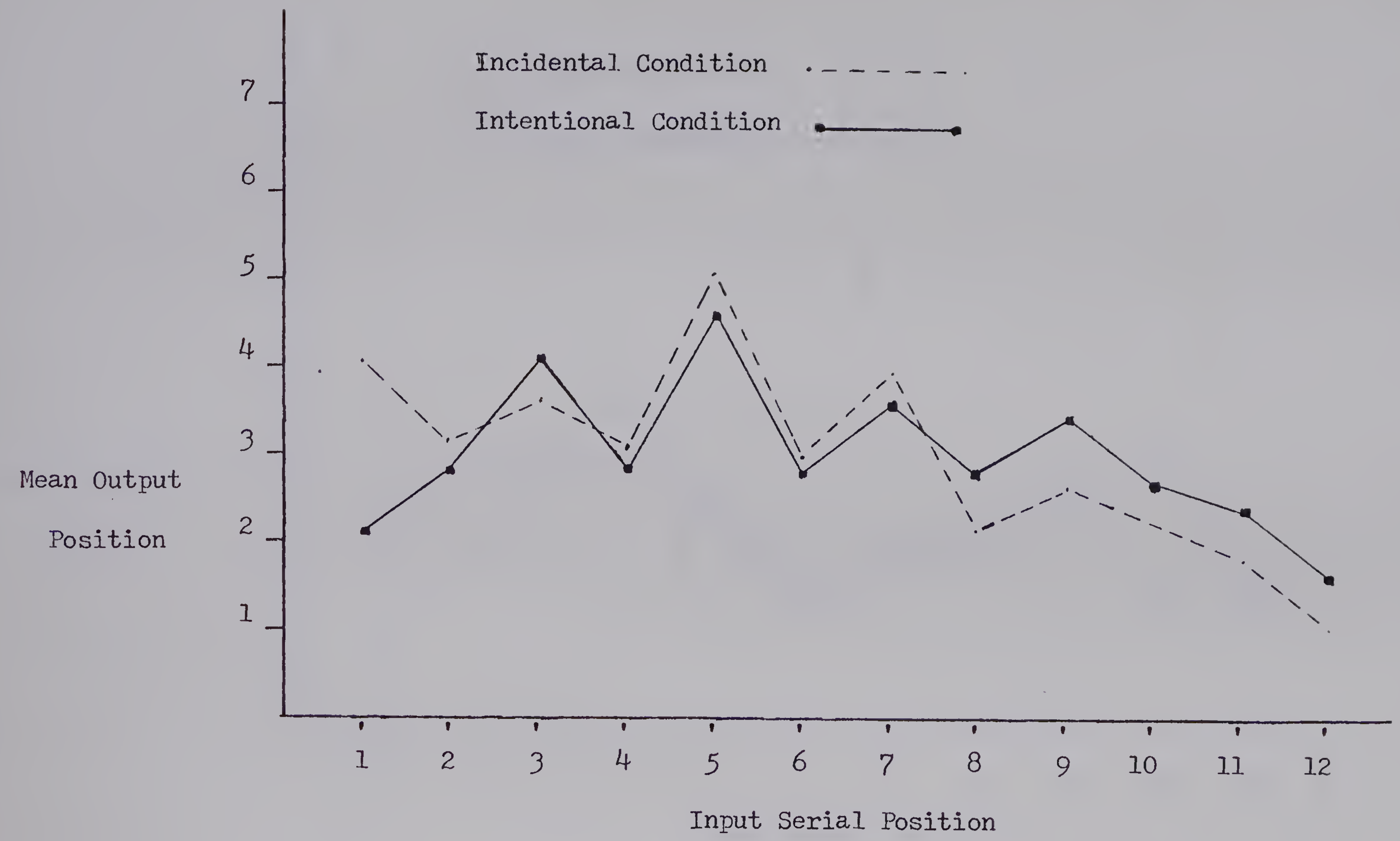

Figure 3

Mean Output Position for Normally Achieving Children

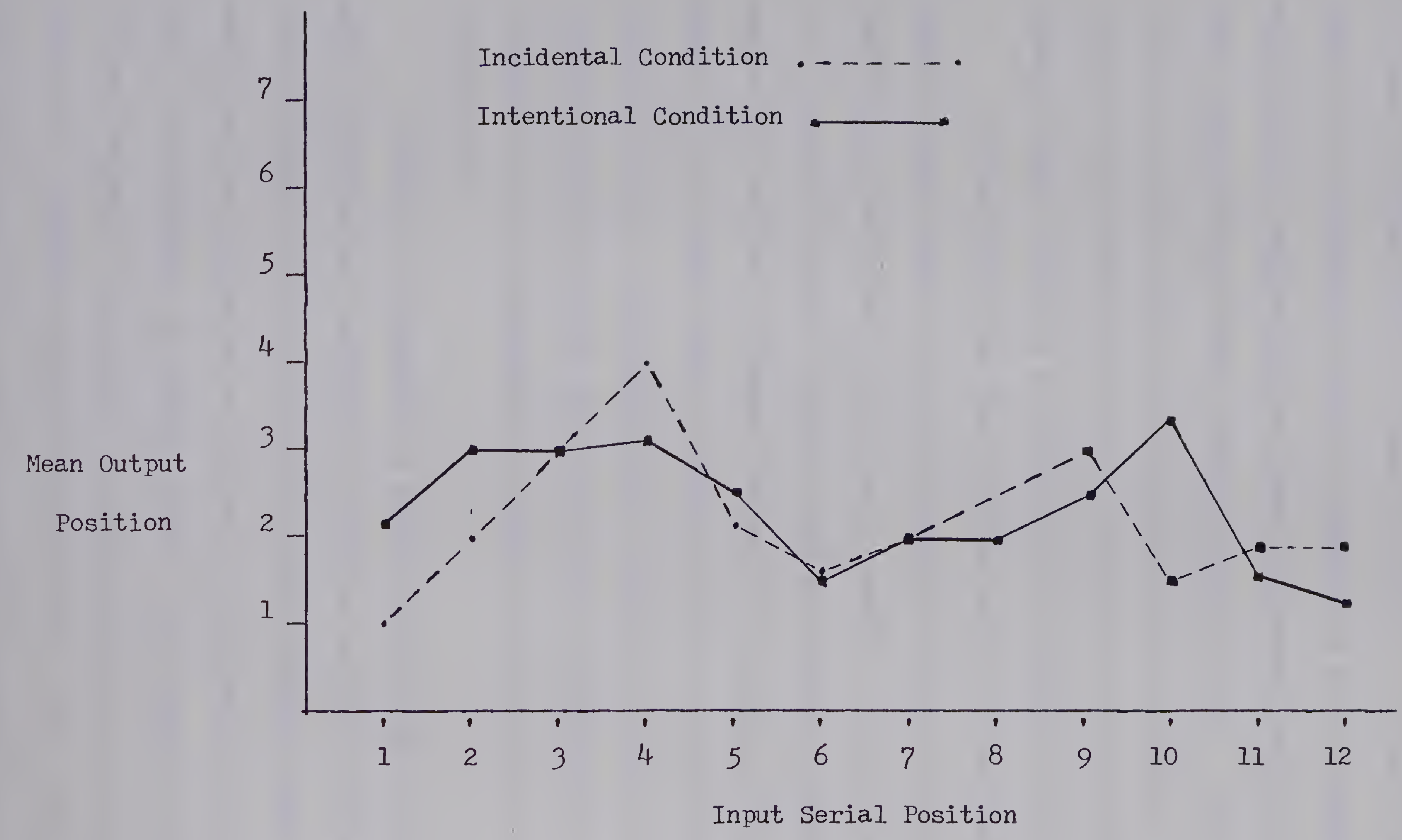

Figure 4

Mean Output Position for Learning Disabled Children

The mean output results of the learning disabled children are shown collapsed into one group in Figure 5. Primacy/recency effects for this group are not as distinct as for the normally achieving group suggesting that there is greater variability in memory organization for the learning disabled group. Unlike the normally achieving group, the learning disabled children do not respond to the intentional learning condition with increased primacy; rather, there is an indication of increased recency effect.

It was also noted that the mean output of the learning disabled group appears to be more strongly influenced by the read/generate processing conditions than by overall item position. That is, if the first six and last six items are analyzed separately for mean output position, a clearer indication of primacy and recency effects is given than when the standard whole list (12 items) analysis is used. This suggests that retrieval of items for the learning disabled children was more strongly differentially influenced by the read/generate encoding conditions than by overall item position.

Finally, a comparison of mean output for the two groups under intentional and incidental conditions was made (Figures 5, 6). This comparison indicates that while recency effects under both intentional and incidental conditions are similar for both groups, there is a difference in primacy effects. The normally achieving children respond to intentional learning conditions with increased primacy, the learning disabled children do not. Under incidental conditions, however, the normally achieving children do not show

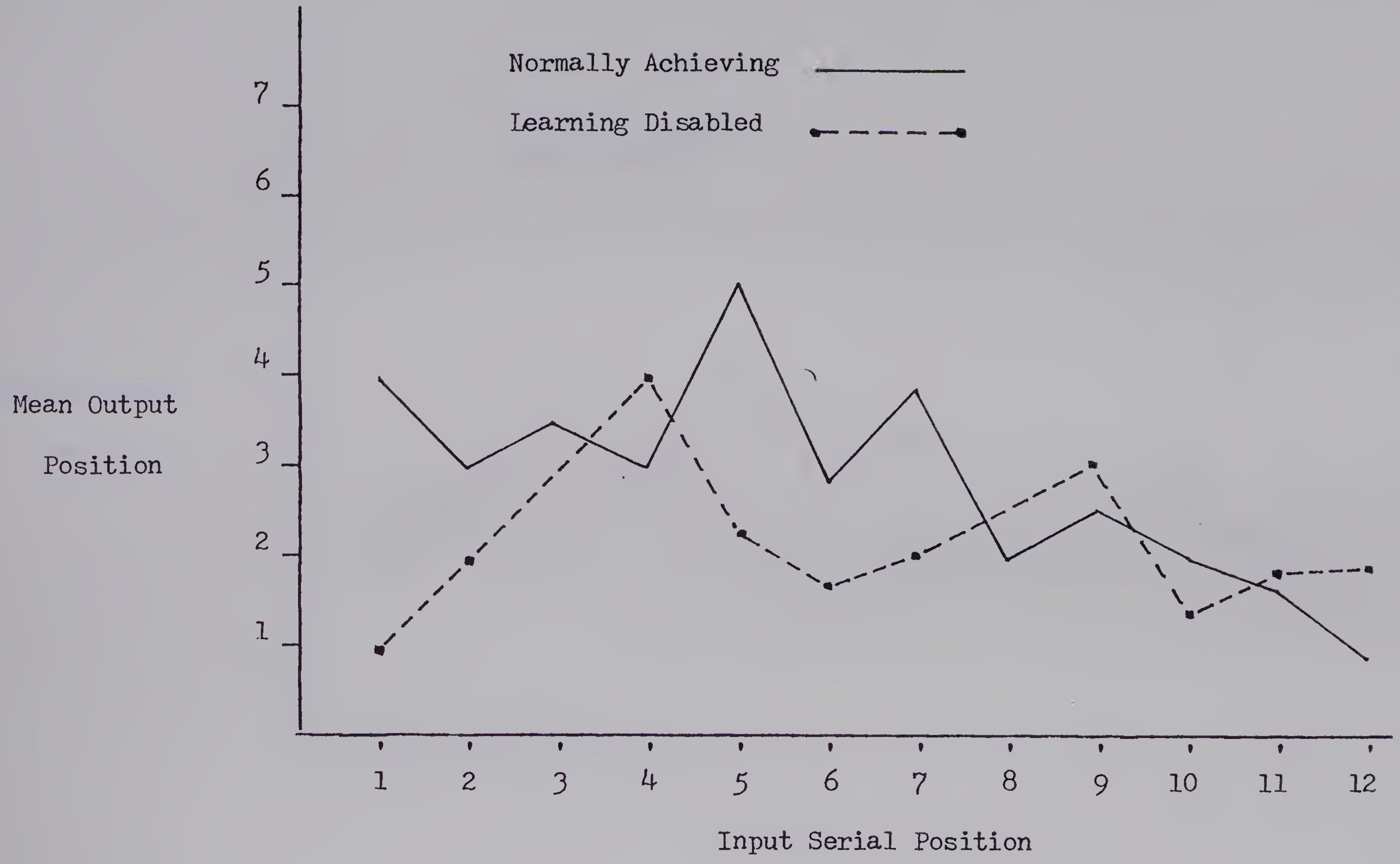

Figure 5

Group Comparison of Mean Output Position for Incidental Condition

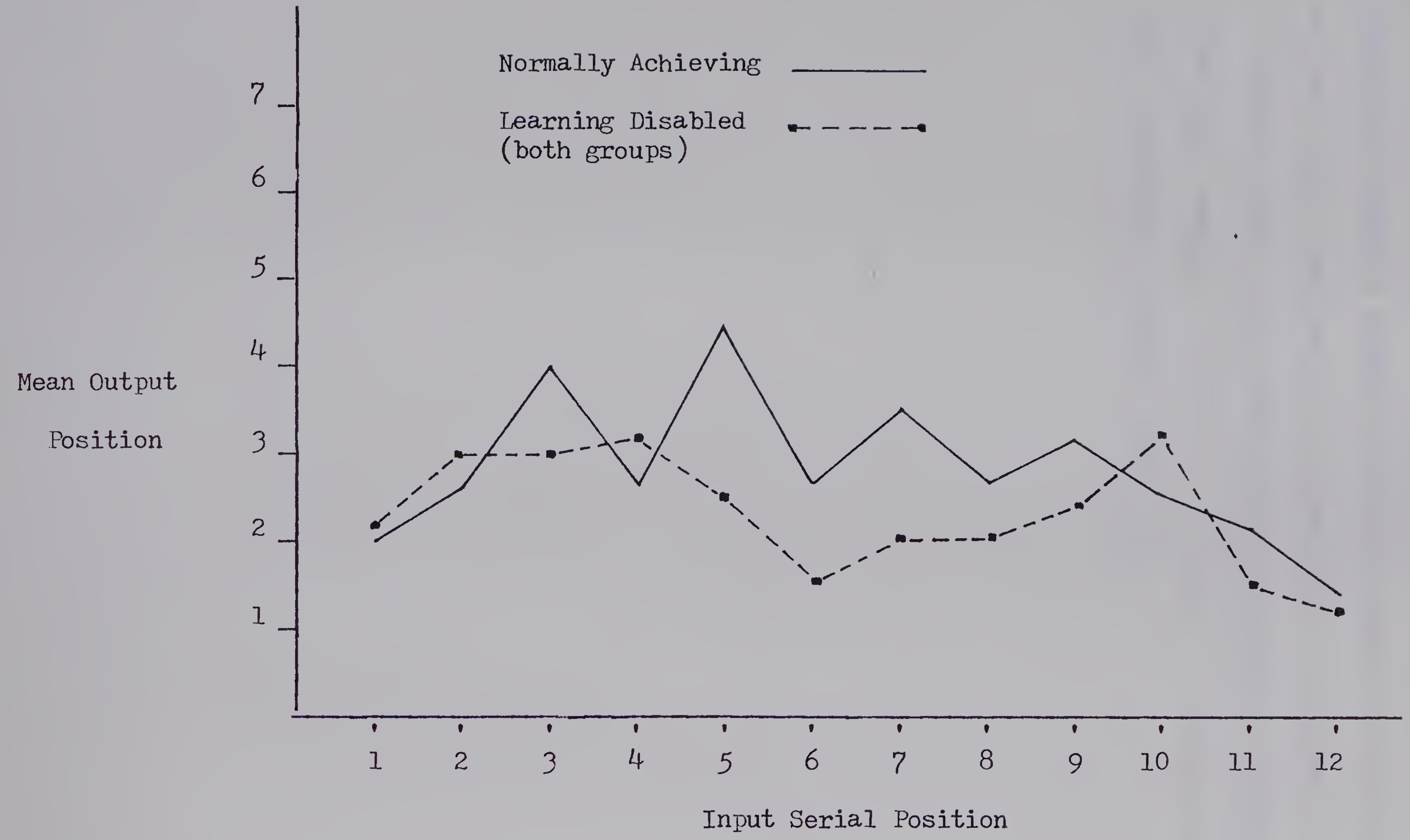

Figure 6

Group Comparison of Mean Output Position for Intentional Condition

greater primacy than the learning disabled group. While decreased primacy for learning disabled children compared to normal children has been widely reported in the literature, as discussed in Chapter 2, there has been little distinction made between incidental and intentional learning conditions. The present findings suggest that such a distinction may be a useful one.

CHAPTER 6

DISCUSSION

A major finding of this study was that the generate orienting task resulted in greater recall than the read condition for normally achieving but not learning disabled children. To attempt to understand this finding it is necessary to (1) examine more closely the theoretical rationale for the superiority of the generate condition in adult studies (McElroy & Slamecka, 1982; Slamecka & Fevreiski, in press) and (2) examine differences between the active generating task and other active tasks, such as categorizing and labelling, which have been used with learning disabled children.

Slamecka and Graf reported the generation task in 1978 as an empirical finding. At that time possibilities advanced for the memorial benefits of generation included deeper processing, prior retrieval, heightened arousal, greater effort, and greater compatability of study and test conditions. These possibilities were seen as falling into two main categories: (1) semantic explanations and (2) the automatic consequences of generating (McElroy & Slamecka, 1982). The latter, "automatic" benefits, were seen as applying to the heightened arousal, greater effort, and study-test compatability explanations.

A series of experiments comparing the effects of generating words with non-words found that the generating condition produced greater recall and recognition in words, but not non-words (McElroy

& Graf, 1982). Following from this, the conclusion has been drawn that "contact with the semantic network must be possible if a generation effect is to be observed" (McElroy & Graf, 1982, p. 268). Automatic consequences such as heightened arousal do not account for the findings. Further, findings that the failure to generate a word still resulted in better memory than reading a word has rendered the prior retrieval explanation an unsatisfactory one. These experiments, then, apparently narrow the field of possible explanations for the generation effect to semantic involvement of some description. However, further study in this area is required to render more specific answers. A tentative and rather vague explanation put forth is that "generate traces may be richer in the amount of information encoded at output" (McElroy & Graf, 1982, p. 267) with greater lexical activation resulting for the generated words.

Although not amplified by Slamecka, the reference to richer memory traces, a result of deeper processing, relates both to the breadth of processing and depth of processing concepts developed by Craik (Craik & Lockart, 1972) to explain the durability of memory traces. As discussed in Chapter 2, optimal memory performance is regarded from this viewpoint as resulting from the analysis of material at a semantic, associative level, rather than at more superficial physical or phonemic levels of analysis (Craik & Lockart, 1972). Elaboration, breadth of processing, is seen as an enriching process which follows recognition of the stimulus and may trigger association, images, or stories on the basis of the subject's past

experience with the word (Craik & Lockart, 1972, p. 675). Elaboration, then, can be viewed as a process of contacting lexical networks, and in this sense relates to memory models which describe semantic memory as a network of interrelated concepts (c.f. Lorsbach, 1982). Depth as well as breadth of processing are seen as resulting in more distinctive memory traces which are more easily contacted in memory retrieval operations (Lockart, Craik & Jacoby, 1976).

The idea of distinctiveness is also used by Raye, Johnson and Taylor (1980) as an explanation for their findings with frequency judgements related to generation effects. They view the difference between reading and generating as the difference between externally generated and internally generated events. They basically attribute the benefit to memory of internally generating, as carried out, for example, in the subject generation of opposites, to the greater potential for variation in the functional representation in memory of self-generated words. Because more variation is possible, they suggest, there is greater potential for the memory trace to be unique and distinctive.

While these two interpretations of distinctiveness as applied to the generation effect differ in emphasis with one emphasizing amount of processing (McElroy & Graf, 1982) and the other the nature of internal contrasted with external representations (Raye, Johnson & Taylor, 1980), they both are fundamentally concerned with the elaborative processing carried out by the individual. Following from this view, the normally achieving children in the present study apparently benefitted from the generating task because

they could carry out the elaborative processing required of the generating task. Learning disabled children, on the other hand, apparently were deficient in their ability to carry out this type of processing. The view of learning disabled children as deficient in elaborative encoding, as discussed in Chapter 2, has been put forward by Bauer (1979) and Tarver et al (1976).

It is difficult, however, to satisfactorily explain why learning disabled children would fail to elaborately encode under task conditions which produced this processing in normal children. As shown in the results (Table 7), the mean recall of normally achieving children was significantly greater in the generate as opposed to read condition, the learning disabled group matched in reading level to the normal group had slightly greater mean recall in the generate condition, and the younger learning disabled group recalled less in the generate condition. In the pilot study as well, there were greater benefits to good readers than poor readers in the generate condition. While this progression of proficiency is in harmony with the explanation of the generation task as requiring elaborative semantic processing as well as various findings that semantic coding efficiency distinguishes good from poor readers (Hess & Radtke, 1981; McFarland & Rhodes, 1978; Perfetti & Goldman, 1976), it does not advance the understanding of the relationship. One possible explanation is that when the elaborative processing is carried out, the appropriate lexical networks are activated, but the representation in memory is weaker, not as distinctive, for learning disabled children as it is for normal

children (Kail, Note 1). However, the weaker representation concept rather "begs the question" and it is possible that looking at encoding alone does not provide answers for learning disabled children.

Eysenck (1978) criticised levels of processing theory as being too dependent upon the strength of item representation in memory and pointed out the importance of the voluntary retrieval strategy used by the subject. Since, in free recall, retrieval involves the subject's generation of his own retrieval cues, the ability to retrieve information may be of particular significance for the learning disabled in view of their designation as inactive learners and difficulties in spontaneous memory organization (Dallago & Moely, 1980; Wong, 1982). Retrieval, then, provides an alternative way of viewing the results of this study.

One difference between the active task of generating used in this study and the active categorizing task used, for example, by Torgesen and Goldman (1977), is that sorting words into categories provides not only for guided encoding but strongly suggests retrieval cues. Although the serial position analysis in the present study offers evidence that the learning disabled children retrieved from the cues provided by the generate and read conditions, there is no connection between the various opposite word pairs and the read/generate condition organization cues. In categorization studies, however, the association between the reductive category cues and the various items is a close one; this may facilitate retrieval. That some portion of learning disabled children do

experience explicit retrieval problems was demonstrated by Ceci, Ringstrom and Lea (1981). They explored the differential effects upon recall of guided encoding and guided retrieval and found that some learning disabled children benefitted only from retrieval cues, suggesting that retrieval, not encoding, was the central problem.

Another difference between the present study and other "active" studies is in the level of strategic behaviour presumably called upon. The active labelling task, for example, used by Lewis and Kass (1982) used a labelling strategy that develops fairly early in the childhood years, prior to age 8, and which precedes more complex strategic behaviours such as cumulative rehearsal (Torgesen & Kail, 1980). The strategic demands imposed by the generate task, in view of the conceptual nature of generating opposites, may require task strategies not in the repertoire of the learning disabled children at the ages studied. Newman and Hagen (1981), for example, trained two age groups of learning disabled children, 7 to 10 years, 11 to 13 years, in a memory strategy considered to be within the capabilities of normal children of age 7 to 10 years. They found that only the older group of learning disabled children were able to respond to strategic training and concluded that the required strategy was absent from the strategy repertoire of the younger children. The failure of the learning disabled children in the present study to benefit from the generating task may also be the result of the absence of necessary strategic behaviour.

In summary of this point, various explanations may be offered for the failure of the generate task to produce greater

recall in learning disabled children. The reason may lie in the area of impoverished representation in memory, it may lie in the area of retrieval strategies, or the explanation may be that the task demands were too great for the ages studied. Further study would be required to enable a more precise explanation. The comparative study of recognition and recall memory with learning disabled children using the read/generate tasks, for example, would provide more information about retrieval. Replication of the present study with older age groups of learning disabled children would help to answer developmental questions of memory change with age.

A major finding of this study was in the area of release from interference effects following the analysis procedure of Murdock and Carey (1972) for single trial interference analysis. Marked recency effects were found for the last item in each of the read/generate conditions suggesting a reduction in retroactive interference as a result of processing change. Previous studies in interference release in learning disabled children have centered about auditory/visual modality release (Lehman & Brady, 1982) and categorical release (Nelson & Warrington, 1980). These studies using multi-trial presentations, found no differences for proactive release effects between learning disabled and normally achieving children. The present study, using a single list presentation, found no difference between learning disabled children and normally achieving children for the encoding dimension of the read and

generate task strategies. The present study, then, extends the findings of previous research to another encoding dimension. That is to say, the learning disabled and normal children both showed comparable serial position effects from a change in processing.

That learning disabled and normally achieving children showed no difference in their encoding of the read/generate task dimension gains added significance when it is viewed from the point of reductive coding. As discussed by Herriot (1974), reductive coding is distinguished from elaborative coding in that

> ...reduction coding reduces the amount of material the subject has to process; elaboration coding adds to it. Both types of coding serve to assist recall performance: reduction coding by easing the information load on the system, elaboration coding by making material more distinctive from other material. (p. 8)

The serial position data suggests, then, that learning disabled children may be as efficient as normally achieving children in their use of reductive coding. However, as previously discussed, their elaborative coding may not be sufficiently effective to permit items to be distinctive and, hence, easily retrieved.

There is some evidence, then, that poor memory retrieval may account, at least in part, for the poorer recall of the learning disabled children. This is suggested by the fact that although memory recall for the learning disabled children is poorer than that of the normally achieving children, their pattern of encoding and organization of memory, as reflected in the serial position curves and release from interference data, is similar for both groups. Information may be stored in memory, then, which is not as

accessible or easily recovered for the learning disabled children. A recognition test which requires recognition of an item as opposed to actually retrieving the item as in recall would provide some information concerning the parameters of the deficit occuring in the retrieval stage of processing. Ford and Keating (1981) found for children in grades 4 and 7 a positive correlation between verbal ability as measured in verbal concept tests and retrieval efficiency on memory tests. A relationship of this nature may in turn be related to the finding in the present study that the ability to benefit from the generating orienting task as demonstrated in recall was better for good readers than poor readers in the pilot study; for normally achieving children than learning disabled children in the main study.

In general, the analysis of serial position showed similar patterns of recall for the learning disabled and normally achieving children. This can be seen in the serial position mean probabiility of recall analysis, the release from interference analysis, and, to a lesser extent, in the mean output analysis. These findings support the idea of the memory of the learning disabled child as being qualitatively similar to that of the normal child (Dallago & Moely, 1980; Lorsbach, 1982).

There is a difference, however, in mean output position in response to the intentional learning condition. In the intentional condition the normally achieving, but not learning disabled, children responded with a greater primacy effect. One interpretation of the primacy effect is that it represents intentional efforts to store information (Huttenlocher & Burke, 1976). In terms of the mean

output analysis of the incidental condition, there was no greater primacy effect for the normally achieving children than the learning disabled children. This suggests that the widely reported finding of decreased primacy for learning disabled children may be true only under intentional learning conditions although this distinction is often not made in the literature. This point requires further clarification.

The discussion of serial position analysis from this study must bear in mind the limitations imposed by (a) the lack of statistical item analysis and (b) the fact that the word lists were drawn up to allow condition equivalence (read/generate; incidental/intentional) rather than item equivalence. However, when lack of item equivalence could be seen to be affecting results, as in items 1 and 2 of the incidental list, this has been pointed out.

In the area of incidental/intentional conditions, the ANOVA results showed no recall differences for either learning disabled or normally achieving children between these conditions. The failure to find large enough differences to be statistically significant between the incidental and intentional conditions may be related to the fact that in both conditions the child was involved in reading and generating tasks, which may have accounted for most of the processing carried out. Maximum memory efficiency, then, may have been reached in the incidental condition so that instruction to remember resulted in little difference. This would agree with the contention of Craik and Lockart (1972) and Brown (1975) that it is processing per se, not intent to remember, that is significant to

memory.

As indicated by the ANOVA results, there was no difference, other than total recall, between the two learning disabled groups. The means for the various conditions, however, as reported in Table 7, show that like the normal children and unlike the younger learning disabled group, the 11 and 12 year old learning disabled children had greater mean recall in the generate condition compared to the read condition. Although the difference was small, it contrasts with the younger learning disabled group where mean recall was greater under the read than generate condition. As well, the older learning disabled children had greater mean recall in the intentional condition compared with the incidental condition. Again, this parallels the recall pattern of the normally achieving children, but is unlike the younger learning disabled group who showed no difference in mean recall for the two conditions. The failure to find statistical significance between the two learning disabled groups as shown in the ANOVA results may be the result of the small number of children, ten per learning disabled group, involved in the study.

Finally, as expected, total recall was greater for the normally achieving children than for the learning disabled children. This is in accord with numerous studies reporting quantitative differences between the two groups for the amount remembered.

Limitations

It was felt that the age of children studied might have

been rather young for obtaining optimal contrast between the read and generate conditions. The conceptual activity involved in the opposite generating task plus the reading task may have been appropriate for a slightly older age group. Additionally, since age 10 is often cited as an important marker age in strategic development, it may have been better for the tasks used in this study if children 10 years of age or older, rather than this age, were studied.

The study may have been hindered by the small number of children, especially in the learning disabled groups. While the numbers were restricted in an attempt to ensure that the participating children met the sample criteria closely, the numbers may have been so small that, especially in the case of the learning disabled groups, differences may have been masked.

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APPENDIX A

WORD LISTS

APPENDIX A

PILOT WORD LIST

Incidental Condition List	Intentional Condition List
up down	good bad
mother father	wet dry
fast slow	open shut
in out	win lose
happy sad	come go
found lost	under over
day night	hot cold
old new	big little
off on	top bottom
first last	girl boy
black white	asleep awake
no yes	give take
summer winter	rich poor
hello good-bye	long short

Demonstration Items

1. fat thin
2. dirty clean
3. early late
4. crooked s------- (straight)
5. sweet s--- (sour)
6. near f-- (far)
7. love h--- (hate)

WORD LIST

Incidental Condition List	Intentional Condition List
up down	come go
mother father	hot cold
old new	asleep awake
win lose	give take
in out	fast slow
happy sad	girl boy
open shut	wet dry
first last	off on
black white	no yes
summer winter	top bottom
day night	rich poor
hello dood-bye	long short

Demonstration Items

1. fat thin (illustrated)
2. dirty clean
3. good bad
4. big l----- (little)
5. under over
6. sweet s--- (sour)
7. front b--- (back)

APPENDIX B

EXPERIMENTAL SEQUENCE

APPENDIX B

EXPERIMENTAL SEQUENCE

The child is seated at the table.

"Do you know what an opposite is?"

Display card #1 (fat thin) so that the bottom of the card rests on the table about six inches from the edge of the table facing the child.

"The opposite of fat is thin."

"The opposite of dirty is (pause) clean."

Display card #2.

"I am going to show you some cards with opposites printed on them. Some of the time you will just need to read the opposites out loud. Like this..."

Display card #3. Child and examiner read the card aloud.

"Some of the time you can read the first word of the opposite, but just the starting letter of the other word will be there. Then you need to think of what the missing word is and say it outloud. Like this..."

Display and read #4.

"Let's practice a few."

Display and read consecutively cards #5, 6, and 7. The child reads and generates. The examiner gives help if required.

"Okay. You know what to do."

Display cards 1-12 from the incidental list. Each card is displayed

one at a time for a time interval of 3 seconds. If the child cannot read a word, the examiner should supply it. If the child has not generated the required second word of the pair by the end of 3 seconds, the examiner should supply it for him/her.

> "Now tell me all the words you can remember that you have just said outloud. Tell me all the opposites you can remember."

Allow 90 seconds for recall. Record the responses in the test protocol. Give encouragement such as "good" after the first few responses. Ask, "Can you think of any more?" if the child finishes before the 90 seconds are terminated.

> "Now we're going to do the same thing over again. You are going to read some opposites from cards. Then, at the end, tell me all you can remember."

The intentional cards 1-12 are then displayed in the same manner as the cards for the incidental list.

> "Now tell me all you can remember from <u>those</u> cards."

Record the responses. Allow 90 seconds for recall. Ask, "Can you think of any more?" if the child concludes before the 90 seconds are terminated.

At the conclusion, praise and thank the child with words such as "you've done very well. Thank you."

APPENDIX C

Supplementary Analysis of Incidental/Intentional Conditions
for Groups using Correlated t-tests

Group	df	t
Normally Achieving	29	1.70
Learning Disabled 9 and 10 years	9	0.00
Learning Disabled 11 and 12 years	9	1.94
Total Learning Disabled	19	1.92